MONTHLY WEATHER REVIEW.

Editor: Prof. CLEVELAND ABBE.

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INTRODUCTION.

The MONTHLY WEATHER REVIEW for March, 1899, is based on about 2,762 reports from stations occupied by regular and voluntary observers, classified as follows: 162 from Weather Bureau stations; numerous special river stations; 32 from post surgeons, received through the Surgeon General, United States Army; 2,385 from voluntary observers; 96 received through the Southern Pacific Railway Company; 29 from Life-Saving stations, received through the Superintendent United States Life-Saving Service; 31 from Canadian stations; 10 from Mexican stations; 7 from Jamaica, W. I. International simultaneous observations are received from a few stations and used, together with trustworthy newspaper extracts and special reports.

Special acknowledgment is made of the hearty cooperation of Prof. R. F. Stupart, Director of the Meteorological Service of the Dominion of Canada; Mr. Curtis J. Lyons, Meteorologist to the Hawaiian Government Survey, Honolulu; Dr. Mariano Bárcena, Director of the Central Meteorological and Magnetic Observatory of Mexico; Mr. Maxwell Hall, Government Meteorologist, Kingston, Jamaica; Capt. S. I. Kimball, Superintendent of the United States Life-Saving Service; and Capt. J. E. Craig, Hydrographer, United States Navy.

The REVIEW is prepared under the general editorial supervision of Prof. Cleveland Abbe.

Attention is called to the fact that the clocks and self-registers at regular Weather Bureau stations are all set to seventy-fifth meridian or eastern standard time, which is exactly five hours behind Greenwich time; as far as practicable, only this standard of time is used in the text of the REVIEW, since all Weather Bureau observations are required to be taken and recorded by it. The standards used by the public in the United States and Canada and by the voluntary observers are believed to conform generally to the modern international system of standard meridians, one hour apart, beginning with Greenwich. Records of miscellaneous phenomena that are reported occasionally in other standards of time by voluntary observers or newspaper correspondents are sometimes corrected to agree with the eastern standard; otherwise, the local meridian is mentioned.

FORECASTS AND WARNINGS.

By Prof. E. B. GARRIOTT, in charge of Forecast Division.

The weather changes and conditions during March, 1899, did not vary materially from the seasonal average. The principal cold wave of the month crossed the country east of the Rocky Mountains from the 4th to the 7th, causing frost and freezing weather in the Gulf and South Atlantic States during the 6th and 7th.

Three well-marked and energetic storms visited the Atlantic seaboard. One of these developed off the North Carolina coast on the 6th and moved northeastward along the middle Atlantic and New England coasts during the 6th and 7th, attended by winds of from 50 to 60 miles an hour. From the 15th to the 19th a storm traversed the country from the middle Pacific coast to New England. This storm developed great strength while crossing the central valleys and showed barometric readings below 29.00 inches on the New England coast, with winds 40 to 50 miles an hour along the entire Atlantic coast and a maximum velocity of 72 miles per hour from the northwest at New York City. The third storm of the month moved from the West Gulf States to New England from the 27th to the 29th. On the morning of the 29th the barometer at Portland, Me., read 28.90 inches, and gales of from 50 to 60 miles an hour prevailed along the Atlantic coast.

In anticipation of the frosts which occurred on the 10th, 11th, and 12th, special frost warnings were issued for California by the San Francisco office of the Weather Bureau, on March 9.

Special flood warnings were issued from Portland, Oreg., on the 2d and from San Francisco on the 24th.

No special injury is known to have been caused by the cold wave, frosts, and storms referred to, and no special benefits are known to have resulted from the timely and ample warnings issued in connection with their occurrence.

CHICAGO FORECAST DISTRICT.

The weather conditions during March were governed by frequent storms which moved from the Pacific coast across the Rockies, and then passed thence to the southeast or east. This feature resulted in unseasonably cold weather.

On the morning of the 5th, on account of the appearance of an area of high barometer of great magnitude over the extreme Northwest, the following special message was sent to the observers in Minnesota, Wisconsin, Illinois, Indiana, Missouri, Iowa, Upper and Lower Michigan, and extreme eastern Nebraska:

Unseasonably cold weather indicated for your section to-night and Monday; notify interests.

During the morning of the 10th another cold wave developed in the British Northwest. At the same time a well-marked storm was over Kansas, which, during the succeeding forty-eight hours, moved northeastward over the Lake region.

The storm was accompanied by some snow in the district and followed by a cold wave, but with diminishing intensity. The movement of the storm was amply covered by cold-wave and norther warnings, and by advisory messages to the vessel interests on Lake Michigan.

Still another co'd wave appeared on the 14th in the British Northwest and overspread the Rocky Mountain region and eastern slope during the succeeding twenty-four hours, for which necessary warnings were issued. The storm preceding this cold wave moved from eastern Colorado to Lake Michigan in twenty-four hours, causing high winds on the lake. Vessel interests were warned as to the approach of the storm.

A fourth cold wave moved, during the 25th, 26th, and 27th, southward over the Rocky Mountain region and eastern slope; warnings were furnished to nearly all threatened points.—*H. J. Cox, Professor.*

SAN FRANCISCO FORECAST DISTRICT.

Prior to the 13th, the rivers in California were extremely low owing to the drought of the past season and the light rains of the present season up to that date. On the 23d, they began to rise quite rapidly. On the evening of the 24th, a forecast was made that "the lowlands, in the lower portions of the Sacramento and San Joaquin valleys would be flooded by Sunday, the 26th." This was fully verified. The crest of the high water was reached on the 26th, and the afternoon reports showed a general fall. The damage caused by the overflow was slight.

Wind signals were displayed on the 14th, 15th, 16th, and 17th, and again on the 22d and 28th. As usual these warnings were heeded and no disasters occurred.

On the morning of the 9th, the conditions shown on the weather map indicated severe frosts in California. Forecasts were issued at once giving warning of severe frosts throughout the State. Besides the regular distribution of these warnings by displaymen, the daily press, the maps, and forecast postal cards of the Weather Bureau, they were given to the Southern Pacific and San Francisco and San Joaquin Valley railroad companies, which caused the same to be bulletined by their agents throughout the State. Similar warnings were again issued on the 10th and 11th, and distributed in the same manner as were those of the 9th. The usual measures to prevent injury were resorted to, and it is believed with much success. Damaging frosts occurred on the mornings of the 10th, 11th, and 12th. Owing to the advanced stage of the fruit buds the almonds and apricots were seriously damaged, especially the former. Later developments, however, show the injury not so great as was at first anticipated.

On the 10th, warnings of severe frosts were sent to southern Arizona. On the morning of the 11th, Phenix reported a minimum temperature of 32°, but I have not been advised of any injury experienced.—*G. H. Willson, Local Forecast Official.*

PORTLAND, OREG., FORECAST DISTRICT.

River forecasts were issued on March 1, 2, 3, 4, 5, and 6. On March 2 a warning message was sent to the merchants and others in the threatened districts. The newspapers gave the warning great prominence.

Owing to the low stage of the Columbia, and the further fact that there was no rise in that river, the lower Willamette fully discharged its waters and it did not rise in this city as high as was expected; however, for all practical purposes the river forecast was verified.

The season has been backward and frosts were of frequent occurrence, no special frost forecasts were issued because they could be of no benefit.

Many sensational reports were published by the papers concerning damage done to fruit, wheat, and stock by the February freeze and unseasonable March weather, but information given on the subject by this office rapidly and readily checked the ill effects produced by the unwarranted reports.—*B. S. Pague, Forecast Official.*

AREAS OF HIGH AND LOW PRESSURE.

During March the tracks of eight highs and eleven lows were sufficiently well defined to be traced on Charts I and II, and the principal points regarding their place of origin and ending, duration, and velocity are given in the accompanying table. The ovals delineating these highs and lows were much better located this month than is ordinarily the case, and their progress across the country could be fairly well traced.

Highs.—All the highs began to the north of Montana, except the last, which began in Wisconsin. Four of them were last noted over Nova Scotia or Newfoundland; Nos. II and VI disappeared off the middle Atlantic coast, No. VII in the middle Gulf, and No. I to the north of Lake Superior. The general tendency was toward the east, but for three of the tracks toward the south and southeast. The sharp falls in temperature were as follows: As high No. III moved out of Manitoba on the evening of the 11th, Kansas City had a fall in temperature of 38° in twenty-four hours, and at 8 a. m. of the 12th Springfield, Mo., reported a fall of 36°. This cold wave moved rapidly north, and disappeared on the morning of the 13th over Ontario. On the morning of the 19th, while No. V was to the north of Montana, a fall of 36° occurred in northern Louisiana. On the evening of the 28th, as high No. VII approached the west Gulf, Montgomery reported a fall of 36°, and at the 8 a. m. report of the 29th a fall of 34°.

Movements of centers of areas of high and low pressure.

Number.	First observed.			Last observed.			Path.		Average velocities.	
	Date.	Lat. N.	Long. W.	Date.	Lat. N.	Long. W.	Length.	Duration.	Daily.	Hourly.
High areas.		°	°		°	°	*Miles.*	*Days.*	*Miles.*	*Miles.*
I	1, p. m	52	116	4, a. m.	50	85	1,350	2.5	540	22.5
II	4, a. m.	50	110	9, p. m.	29	80	2,280	5.5	415	17.3
III	9, p. m.	51	113	15, p. m.	47	59	2,520	6.0	420	17.5
IV	13, a. m.	53	115	18, p. m.	45	61	3,090	5.5	562	23.4
V	18, p. m.	53	108	23, a. m.	48	53	3,330	4.5	740	30.8
VI	20, p. m.	51	116	25, a. m.	37	75	2,220	4.5	493	20.5
VII	25, a. m.	52	119	29, a. m.	32	89	2.520	4.0	630	26.2
VIII	26, a. m.	43	90	29, a. m.	46	58	1,650	3.0	550	22.9
Total							18,960	35.5	4,350	181.1
Mean of 8 paths							2,370		544	22.7
Mean of 35.5 days									534	22.2
Low areas.										
I	*28, a. m.	48	124	3, a. m.	41	69	2,910	3.0	970	40.4
II	1, a. m.	34	98	6, a. m.	50	64	2,100	5.0	420	17.5
III	5, p. m.	36	89	8, p. m.	48	52	2,340	3.0	780	32.5
IV	6, a. m.	52	114	9, p. m.	42	73	2,100	3.5	600	25.0
V	8, a. m.	47	126	13, p. m.	47	50	3,960	5.5	720	30.0
VI	12, a. m.	49	124	17, a. m.	47	51	3,900	5.0	780	32.5
VII	14, a. m.	44	125	20, p. m.	49	62	3,720	6.5	572	23.8
VIII	19, a. m.	52	122	25, p. m.	47	56	4,710	6.5	725	30.2
IX	23, a. m.	51	124	27, a. m.	48	56	3,510	4.0	877	36.6
X	23, a. m.	37	105	30, a. m.	52	63	3,540	7.0	506	21.1
XI	28, p. m.	49	114	†1, a. m.	48	61	3,540	3.5	1,011	42.1
Total							36,330	52.5	7,951	331.7
Mean of 11 paths							3,303		724	30.2
Mean of 52.5 days									692	28.8

*February. †April.

Lows.—Six of the lows originated in the north Pacific, No. IX to the north of Montana, No. X in Colorado, and Nos. II and III in the lower Mississippi Valley. The general movement was toward southeast and east. Nos. I and IV

were last noted off the New England coast, and the remaining nine over the Gulf of St. Lawrence or Newfoundland. The following high winds were reported on the evening of the 5th. As No. II passed across Ontario it caused a west wind of 64 miles an hour at Buffalo. On the morning of the 7th, as low No. III moved up the middle Atlantic coast, Block Island reported a northeast wind of 60 miles, and that same evening Eastport had northeast 60. On the morning of the 12th, as No. V moved to the upper Lake region, Chicago had 60 southwest. As low No. VI moved into Ontario, Buffalo had southwest 56. As low No. VII moved to the New England coast it caused the highest wind of the month, 72 miles from northwest at New York on the evening of the 19th, and the same station reported previously the same velocity and direction on the evening of the 29th as low No. X approached the Atlantic coast.

RIVERS AND FLOODS.

Nothing of importance in connection with river stages occurred during March, 1899, in that portion of the Mississippi River system north of Cairo. After the ice broke at Dubuque and south of Omaha during the second decade of the month there was a rapid rise in both the Mississippi and Missouri, due to comparatively heavy rains, but no high stages were reached except in the Illinois River. At Peoria the river was above the danger line of 14 feet from the 13th to the 28th, inclusive, reaching a stage of 15.1 feet on the 22d. At Beardstown stages above the danger line of 12 feet occurred during the entire month, with a maximum stage of 15.1 feet on various dates between the 6th and 14th.

East of Cairo the headwaters of the Ohio system rose rapidly from the 3d to the 6th, on account of heavy rains, particularly in West Virginia. At Charleston, W. Va., the Kanawha River rose 30.7 feet from the morning of the 4th to midnight of the 5th, reaching a stage on the latter date of 41.5 feet, 11.5 feet above the danger line, and with one exception the highest recorded stage. The highest previous stage was 46.9 feet, in September, 1861.

At Pittsburg there was a rise of 10 feet during the same time, a stage of 22.0 feet, just the danger line, having been reached. The crest of this rise reached Wheeling, W. Va., on the 7th and Parkersburg on the 8th. At Point Pleasant, W. Va., the rise from the Kanawha hastened the crest stage, and on the 7th there were 47.2 feet of water on the gauge, 8.2 feet above the danger line.

The necessary warnings were issued from Parkersburg on the 4th and 5th for the rises at Charleston and Point Pleasant. Commendatory notices of these warnings were received later, and the following extracts are taken from the special report of Mr. J. W. Crider, River Observer at Charleston, W. Va.:

This flood came upon us more suddenly than any previous one within my recollection. From a stage of 10.8 feet on the 4th, the river rose to 41.5 feet by midnight of the 5th. Special warnings from Hinton, W. Va., and information obtained by telephone from the United States Engineers as far above as Kanawha Falls prepared the people of this city, and by night of the 4th nearly all in the flooded district had removed to places of safety. On the morning of the 5th, when the gauge stood at 36.7 feet, I posted a notice that the river would continue to rise until it reached 41.3 feet. It did reach this stage, and exceeded it by 0.2 foot at midnight. Beyond the inconvenience and loss of time suffered by business interests, the damage was trifling. The fact that great loss did not occur can only be attributed to the timely warnings issued by the Weather Bureau. The smaller towns along the river did not fare so well. At Winifrede the dry docks and ten barges were swept away, and several coal tipples at other points were taken.

This rise also reached Catlettsburg, Ky., on the 7th, with a stage of 56.3 feet, 6.3 feet above the danger line, and Portsmouth, Ohio, with a stage of 55.8 feet, 5.8 feet above the danger line. Damage to the amount of $1,000 was caused by the flood at the latter place. The Licking River was also in flood, reaching 27.7 feet at Falmouth, Ky., on the 5th, 2.7 feet above the danger line. The following history of this flood was furnished by Mr. S. S. Bassler, Official in Charge of the United States Weather Bureau Office at Cincinnati:

On Saturday, the 4th instant, the reports showed a tremendous rise in the Great Kanawha and other mountain streams, and the announcement was at once published and otherwise disseminated, that the storm then in progress was materially changing the river situation and that during Sunday and Monday the river would rise rapidly here with prospects of more water than we have had this winter.

On Sunday morning (5th) warning was issued that the river would exceed the danger line (50 feet) by Monday morning, equivalent to a rise of 6 feet. Railroad officials and merchants in the bottoms were notified as far as possible and all took prompt action. The danger line warning was telegraphed to Portsmouth, Ohio, and Catlettsburg, Ky., and warning sent to Louisville, Ky. Residents along the river bottoms were warned, through the police department, of a 50-foot stage by morning, and continued rising waters. By request I telegraphed the situation to the editor Daily Blade, Portsmouth, Ohio, giving him warning of stages above danger line from Point Pleasant down. Although it was Sunday the telephone was in constant use, and merchants first affected by the rising water were busy removing goods out of the cellars.

On Monday morning, March 6, the stage here was 50.3 feet and at Catlettsburg and Portsmouth it had passed the danger line. The forecast was issued as early as possible that the stage would reach 56 feet by Tuesday morning. Flood warnings were telegraphed to the mayors of Higginsport and Ripley, Ohio, Lawrenceburg and Vevay, Ind., and to the wharfmaster at Maysville, Ky. Long distance telephone and telegraphic communication was held with various points from Portsmouth, Ohio, to Lawrenceburg, Ind.

On Tuesday morning, March 7, the stage was 55.1 feet, the high winds and cold wave of Monday night undoubtedly preventing the forecast stage. Tuesday morning's forecast stated that the river would come to a stand by Wednesday morning and would not exceed 58 feet. This announcement from the Weather Bureau was a relief, and merchants whose property was not in danger at 58 feet refrained from incurring the expense of removing it.

On Wednesday morning, March 8, the river at Cincinnati was apparently on the stand at 57.2 feet and the forecast for the day was that the river was practically stationary and would remain so for several hours, possibly rising a tenth or two more, and then begin falling.

To save apparently unnecessary expense to the public the forecast limit of 58 feet was changed to 57.5 feet.

The observers at Louisville, Ky., and Cairo, Ill., were notified by telegraph, and the mayor of Lawrenceburg, Ind., by long distance telephone, of the river conditions here. Between 7 and 8 a. m. the stage rose to 57.3, where it remained until noon, when it fluctuated slightly until 4 p. m., when it had risen to 57.4 feet and there remained until 9 p. m., when it began slowly falling.

The singular fluctuation as recorded by the gauge a part of the day is believed to have been caused by the strong variable winds then prevailing.

The water at Cincinnati remained above the danger line (50 feet) from 6 a. m. of the 6th to 2 p. m. of the 11th.

By reason of the timely warnings, admitted on all sides, and the general readiness for the approach of high water, the loss here was unusually slight. The heaviest loss was to railroad and steamboat interests, and to the latter through inability to pass under the bridges, thereby losing trips.

At Catlettsburg the highest stage (56.3 feet) occurred at 4 a. m. of the 7th, when it was stationary for twelve and one half hours.

At Portsmouth the highest stage (55.8 feet) occurred at 6 a. m. of the 7th, when it was stationary for ten hours.

At Maysville the highest stage (54.1 feet) occurred during the afternoon of the 7th, when it was stationary about six hours.

At Cincinnati the highest stage (57.4 feet) occurred at 2 p. m. of the 8th, when it was stationary seven hours.

The crest reached Louisville on the 10th, with a stage of 32.8 feet, 4.8 feet above the danger line. At Evansville the danger line of 35 feet was reached on the 4th, and the crest stage of 42.7 feet on the 12th. Lowlands above and below the city were flooded, but the only annoying feature was the temporary inconvenience.

The Wabash River also contributed its full share to the general flood, reaching a stage of 18.6 feet at Mount Carmel, Ill., on the 7th, or 3.6 feet above the danger line, and remaining above this point until the 12th.

The flood also extended in a lesser degree to the Tennessee River and tributaries. At Clinton, Tenn., the Clinch River

was 1 foot above the danger line of 25 feet on the 7th of the month. The crest of the rise reached Chattanooga on the 8th, with a stage of 27.6 feet; Florence, Ala., on the 11th, with a stage of 15.1 feet; and Johnsonville, Tenn., on the 13th, with a stage of 24.5 feet, 3.5 feet above the danger line. At this latter place the river was above the danger line during the entire month.

The Cumberland River also made a considerable contribution to the volume of water in the Ohio. A stage of 56.5 feet, 6.5 feet above the danger line, was reached at Burnside, Ky., on the 5th; 39.0 feet, 9.0 feet above danger line, at Carthage, Tenn., on the 10th, and 39.0 feet, 1.0 foot below danger line, at Nashville on the 11th.

At Paducah, Ky., the Ohio passed the danger line of 40 feet on the 10th, but the full effect of the lower tributaries was not felt until the 15th, when a stage of 42.8 feet was recorded.

At Cairo the Ohio rose steadily during the entire month, but the crest of the rise from the upper river evidently passed on the 11th and 12th.

Another wave of much less intensity passed down the Ohio during the second decade of the month, reaching Pittsburg on the 21st, and Evansville on the 27th. This wave also extended in a much more pronounced form to the Tennessee and Cumberland rivers, and thereby prolonged the rise in the Lower Ohio until it was overtaken by the third rise of the month from the upper river, which was caused by the rains of the 28th and 29th. This latter rise began at Pittsburg on the 28th, and at Wheeling, Parkersburg, and Point Pleasant on the 29th. Owing to the increment received from the Kanawha, the rise at the latter place was more pronounced, and a stage of 40.5 feet, 1.5 foot above the danger line, was recorded. Below Point Pleasant the rise was still in progress at the close of the month.

The second rise shortly after the middle of the month caused a flood of somewhat alarming proportions in the Tennessee River, and very high stages were general. At Florence, Ala., the highest stage was 25.2 feet, 9.2 feet above danger line, and at Johnsonville, Tenn., 39.7 feet, 18.7 feet above danger line.

The following extracts relative to this flood were obtained from the special report of Mr. L. M. Pindell, Official in Charge, U. S. Weather Bureau Office, Chattanooga, Tenn.

As the month of March opened with a rising river, following closely upon the high water of February, river men feared a succession of rises during March, and it must be admitted that their fears materialized to a marked degree. During the 14th and 15th heavy rains, averaging 3 or 4 inches, fell over the entire Tennessee watershed, causing washouts and landslides on nearly all the railroads, flooding their yards, and washing away tracks and trestles. During the twenty-four hours ending at 8 p. m., March 15, the Hiwasse River rose 18.5 feet, the greatest twenty-four hour rise on record. At Chattanooga the river rose 10.9 feet, and a stage of 36 to 38 feet was forecast to occur by the night of the 16th. The surface water filled up all depressions and caused considerable trouble to the local transportation companies by flooding their tracks. Flood warnings were sent to all persons interested between Decatur, Ala., and Cairo, Ill., on the 16th. Special observations were called for and special bulletins issued. Information was also telephoned to all railroads and factories in the lowlands and flooded districts. The river began to fall on the night of the 17th, but on the 18th from 2 to 4 inches of rain again fell over the system, and a rapid rise once more set in over both the headwaters and the main stream. There was a repetition of the washouts, etc., of a few days previous, and damage amounting to $15,000 was done to county bridges and roads alone.

On the 19th the following forecast was prepared and issued:

"Crest rise of 28 to 30 feet for Kingston, Tenn., in thirty-six hours; about a 30-foot stage at Bridgeport, Ala.; a 25-foot stage at Knoxville, Tenn., by night of 20th, and between 40 and 42 feet for Chattanooga by the night of the 21st."

Flood warnings were also sent to all interested parties as far as Cairo, and given the widest possible distribution. On the morning of the 20th Knoxville reported a rise of 10 feet, reaching 27.4. This indicated that the river at Chattanooga would reach 42 feet by the morning of the 22d. The forecast was prepared accordingly, and all persons interested were notified to move their goods. Persons moved out of their houses on the 20th, but only when assured that the river would surely reach the 40-foot mark. All merchants and factories having goods under the 40-foot mark, moved them at once on advice from this office, and held goods at the 41-foot mark for further advices. Reports on the 21st indicated that the water would not rise above 40.5 feet, and information to this effect was received by the public with profound expressions of relief. Only on three days was the river free from driftwood, which for about two-thirds of the time, from the 1st to the 20th, was sufficiently heavy to impede navigation.

As far as can be ascertained the amount of property saved by removal as a result of the warnings given, was something over $200,000, while the total amount of damage was not more than $100.

Many communications testifying to the uniform timeliness, accuracy, and great value of the flood warnings were received, but lack of space forbids their reproduction here. The measure of success is dollars and cents, and the figures above given speak for themselves with convincing eloquence.

Stages above danger lines also occurred generally at this time in the Cumberland River, except at Nashville, but no damage resulted from the rise as far as can be learned.

From Cairo to New Orleans there was practically no interruption to the slow and steady advance of the waters, and the rise still continued at the end of the month. Danger lines were passed as follows: At Cairo on the 16th; Memphis on the 16th; Helena, Ark., on the 15th; Arkansas City, Ark., on the 16th, and Greenville, Miss., on the 30th. Below Greenville danger stages were not quite reached, but were indicated at the opening of April.

The Atchafalaya River remained high during the entire month, with a maximum stage of 32.2 feet, 1.2 feet above danger line, on the last day of the month.

The rivers of the Atlantic system remained comparatively quiet in the north, but were not so tractable in the south. From the operation of the same causes which produced the first flood in the Ohio system, the James River was also in flood on the 5th and 6th. A stage of 19 feet, 1 foot above the danger line, was reached at Lynchburg on the 5th, and a stage of 20.5 feet, 8.5 feet above the danger line, at Richmond on the 7th. The following account of the flood at the latter place is from the pen of Mr. E. A. Evans, Official in Charge, United States Weather Bureau Office, Richmond, Va.:

Showery weather had prevailed over the James River watershed on the night of the 3d and the day and night of the 4th, during which considerable rain was deposited, especially in the valley and Piedmont portions of the basin. The occurrence of these rains was well covered by the weather forecasts of the respective dates, and rising water was looked for by this office. The first telegram indicating that the precipitation was getting into the stream came from Buchanan at 9:55 a. m. of the 4th. The day, however, passed without further reports, but thunderstorms occurred on the night of the 4th, and on the morning of the 5th flood water was present in the upper courses of the river.

At 10:30 a. m., in consequence of information received from the special river stations at Columbia and Buchanan and from the official in charge at Lynchburg, a flood warning was issued and notification of same sent your office, as follows:

"Flood warnings issued for authorized points and locally. Twelve-foot stage indicated by 8 p. m. and higher later."

From this hour until the middle of the afternoon the office force was on duty, and as fast as information of the continued rising of the waters was received from Columbia, it was immediately sent out by telephone.

Along the wharves and the lower business streets every one was busy in preparation for the expected flood. In the warehouses large gangs of men were removing goods to upper stories and at the docks everything was being placed beyond reach of the water.

At 6:10 p. m. the last message from Columbia was received giving the gauge reading then as 29 feet, river rising. The height expected at Richmond had been increased to meet the continued rising at upper points, and when this message was received it was placed at 19 feet.

Telephone messages conveying this information were at once sent to all local interests, and later to the police station in the threatened district for distribution by policemen. This proved to be an excellent measure, and by its means many persons were warned who could not otherwise have been reached.

During the day personal inspection of the conditions along the river front were made by the official in charge and special readings of the gauge were made at 1 p. m., 7.2 feet, and 8:05 p. m., 11.0 feet.

Throughout the night the water rose slowly, but steadily, and on the morning of the 6th its height, as indicated by the Bureau gauge at the observation hour was 14.5 feet. At this hour the floors of the lower

or dock warehouses of all the water transportation companies were under water to a depth of several feet, and the river had risen into Main street between Richmond and Fulton (suburb) causing a cessation of street car traffic. It had also backed into some of the sewers, resulting in the flooding of cellars in a large part of the district lying between Fifteenth and Eighteenth streets.

Continued rising prevailed during the day. Special gauge readings were taken at 11:25 a. m., 15.9 feet; 2:45 p. m., 17.5 feet; 3:25 p. m., 17.8 feet; 5:20 p. m., 18.3 feet; and at 8:40 p. m., 19.6 feet.

Late in the afternoon the water had advanced into the city half way between Cary and Main streets, covering an area of about eight blocks, and was still rising. Cellars of stores and residence houses were full of water to the floors. Small boats were used for carrying people, and a general removal of goods and furniture to upper stories was going on in the inundated district and adjoining threatened streets. Throughout the rest of the afternoon and the night the river continued to rise, advancing into Main street and the old market, driving out the marketmen, hucksters, and butchers and cutting off a considerable area of the lower city from street car communication by the Main street line, thus breaking their route at two separate points.

The maximum height of the water was attained at 12:10 p. m. of the 7th, after which it remained stationary a short while, beginning to recede at 2:25 p. m., when a special reading gave 19.7 feet. At this time the water was 2 feet deep on Main street near 17th street. The plant of the Trigg Shipbuilding Company, working on Government contracts for torpedo boats and destroyers, that of the Richmond Ice Company and Davenport and Morris Company, together with much city trackage of the Chesapeake and Ohio and Southern Railways were submerged to a depth of several feet. The city gas works was also in about 2 feet of water and had to suspend operations.

Altogether, all that portion of the city subject to overflow during high water was thoroughly inundated, and only timely warning, coupled with the slow rise of the river, prevented greater damage.

The records of this office, except during the recent ice gorge, do not show an equal volume of water, or such high gauge readings, since the Bureau gauge was erected.

The flood, however, is popularly said to be the greatest since 1889, which it about equals.

The quantity of water carried by the stream was certainly immense, as notwithstanding the fact that the channel was entirely free and unobstructed, water covered the banks over a major portion of the basin, and reached a height nearly equaling that recorded at the most critical period of the ice jam of February 18 last. Many outside points along the river were cut off from communication both by telegraph and rail, and the James River division of the Chesapeake and Ohio Railway suffered much damage from washouts.

The methods taken to warn our local interests were prompt and effective. The first telegram on Sunday morning came from Columbia, and was received at 8:47 a. m. Within fifteen minutes after its receipt it had been sent by telephone to all addresses on our flood warning list. The day being Sunday, it was somewhat difficult to reach several parties, but they all received it in ample time to make necessary preparations, so that, although the flood was of unusual magnitude, there was no instance of loss or damage, except minor or unavoidable casualties.

A noteworthy feature of the flood was the slowness with which its crest moved down. It is almost invariably the case that from ten to eighteen hours elapse between the highest reading at Columbia and at Richmond. In this instance it was considerably more. The only rational explanation apparent is that the flooding of the adjacent lowlands all along the river retarded the forward movement of the crest, or in other words its energy was expended in spreading out rather than moving forward.

If this reasoning be correct, it will have an important bearing in estimating the rate of flood travel and maximum gauge readings in future similar floods. The gauge readings here, as compared with the forecast of "a 12-foot stage at 8 p. m. and higher later," were: 8:05 p. m., 11.0 feet. The last warning, which was sent out at about this hour, forecasted a 19-foot stage for a maximum, and the maximum reached was 20.1 feet, or 1 foot difference in each case. Had full, reliable data for a similar flood been available, it is thought a still closer forecast could have been made.

The weather forecasts issued from your office prior to and during the flood were fully verified.

A minor flood occurred on the 20th and 21st, but it was well anticipated and passed off without damage of consequence.

The rivers of the Carolinas were high at various times during the month, corresponding to the dates of the floods in the Tennessee River. The necessary flood warnings were issued in ample time and were fully justified by the recorded stages of water. The following extract relative to the floods in South Carolina is taken from the report of Mr. L. N. Jesunofsky, Official in Charge, United States Weather Bureau Office, Charleston, S. C.:

The volume of water which passed seaward during February was, on the whole, almost as great as the entire flow which passed by during the past two winters. The streams were generally above the danger points for greater periods than during any one month since the establishment of the river service in 1891. The flood waters kept the bottom lands well submerged, retarding spring plowing. But few casualties are reported other than the drowning of some cattle in the swamps. River men state that the freshets in February were the highest since the great "Sherman freshet," in January, 1865. There was a high freshet in 1867, but not equal to that of February, 1899. The flooding of the swamp lands enabled the lumber men to float the large collections of timber of the past three years. The lumber mills are running on full time and laying in large supplies.

Perhaps the greatest loss and inconvenience occasioned by the floods fall upon the rice planters on the lower streams, in the tide-water sections, where the freshet and tides have elevated the stream flow to such a height as to prevent the proper drainage of lands for plowing, thus retarding operations for over four weeks.

There was a great increase in traffic. Steamers made continuous trips on the Santee, Wateree, the Upper Pedee, and Little Pedee rivers. Drift was running heavily at Camden on the 6th, 7th, 17th, and 27th; at Cheraw and Columbia on the 6th and 7th, and light drift at Camden on the 8th and 18th.

The floods in the Alabama rivers passed off without reaching excessively high stages, and with little damage or inconvenience. The forecasts and warnings were timely and accurate, and were well heeded by those interested.

The rivers of the Pacific coast were quite high at times during the month, but no danger stages were recorded except at Eugene and Albany, Oreg., on the Willamette River. At the former place the river rose to 6.4 feet above the danger line of 10 feet on the 1st, and to 3.0 feet above the danger line of 20 feet at the latter on the 3d. The Sacramento River at Sacramento rose steadily during the month, and on the last day was within 0.9 foot of the danger line of 25 feet.

ICE IN RIVERS AND HARBORS.

Ice conditions changed materially after the close of February. The Mississippi remained frozen north of Dubuque during the entire month. At Dubuque it began to break up on the 11th, and by the end of the month the river was clear of ice below the bridge. It still held above, however.

The ice broke at Leclaire on the 13th; at Davenport on the 12th; at Muscatine, Iowa, on the 11th; at Keokuk on the 10th, and at Hannibal on the 2d. No floating ice was reported south of Keokuk after the 20th. At Cairo the last ice passed down the Mississippi on the 2d.

The Missouri was opened at Omaha by dynamite on the 25th, but the ice still held above the bridge. At Plattsmouth, Nebr., it broke away on the 10th, and moved out without causing any damage. There was floating ice at Kansas City until the 14th, but none after the 10th at Hermann, Mo.

The Des Moines River opened at Des Moines on the 11th. There were some attempts at navigation as far north as Davenport. The ferryboat at that place resumed trips on the 19th, and the first boat passed down through the draw on the 24th.

In the Hudson the gorges began to give way on the 14th; the first boat from below reached Albany on the 16th; floating ice until the 24th, and the first through boat from New York did not arrive until the 29th.

In the rivers of Pennsylvania there was practically no ice after the first week of the month.

The thickness of the ice in the various rivers for each week since December 5, 1898, is given in the following table. It will be noticed that there has been a marked decrease in the quantity since February 27, except in Minnesota and North Dakota. In the northern portions of these States there were from one to two inches more than at the close of February, south of La Crosse and Sioux City the ice has disappeared.

In the rivers of southern New England there was a loss of from 12 to 16 inches in the thickness of the ice.

Thickness of ice in rivers (in inches), winter of 1898–99.

Stations.	December.				January.					February.				March.			
	5.	12.	19.	26.	2.	9.	16.	23.	30.	6.	13.	20.	27.	6.	13.	20.	27.
Moorhead, Minn	13.5	15.0	18.0	20.0	24.0	26.0	26.0	26.0	28.0	32.0	38.0	42.0	42.0	42.0	42.0	44.0	44.0
St. Paul, Minn	10.0	14.0	16.0	18.0	22.0	23.5	22.5	22.5	24.5	28.0	30.0	25.0	23.0	30.0	30.0	30.0	24.0
La Crosse, Wis	6.5	*	13.0	14.0	15.0	20.0	22.0	19.0	26.0	27.0	32.0	22.0	20.0	16.0	20.0	19.0	12.0
Dubuque, Iowa	8.0	10.0	11.0	10.0	14.0	15.0	13.0	10.0	18.0	20.0	27.5	22.0	18.0	20.0			
Davenport, Iowa		1.0	11.0	11.0	12.5	14.0	13.0	12.0	14.0	14.5	21.5	21.5	21.0	20.0			
Keokuk, Iowa		7.0	8.5	10.0	14.0	13.0	12.0	11.0	13.0	15.0	26.0	15.0	10.0	10.0			
Hannibal, Mo		7.0	9.0	6.0	*	11.0			5.0	11.0	16.0	10.0	9.0				
Williston, N. Dak	12.0	12.0	12.0	12.0	16.0	18.0	20.0	20.0	21.0	32.0	32.0	32.0	32.0	30.0	30.0	30.0	30.0
Bismarck, N. Dak	10.0	16.0	18.0	18.0	20.0	20.0	24.0	24.0	*	27.0	34.0	30.0	30.0	30.0	20.0	20.0	24.0
Pierre, S. Dak	11.0	14.0	14.5	15.0	17.0	19.5	19.0	17.5	20.0	23.0	25.0	18.0	14.0	15.0	9.0	9.0	10.0
Yankton, S. Dak	8.0	11.5	15.5	15.5	16.0	16.0	16.0	16.0	18.5	21.5	26.0	25.0	25.0	24.0	20.5	17.0	14.5
Sioux City, Iowa	8.5	12.0	12.0	11.0	15.0	16.5	17.5	16.5	18.0	21.0	24.0	17.0	19.0	18.5	13.0	14.0	12.0
Omaha, Nebr	6.0	8.0	10.0	10.0	*	12.0	*	6.0	10.0	14.0	22.0	20.0	20.0	18.0	14.5	12.0	
Topeka, Kans		2.5	3.0	2.5	4.0				3.5	11.0	15.0	4.0	6.0				
Kansas City, Mo									3.0	8.0	13.0						
Wichita, Kans		3.0							4.0		12.0						
Pittsburg, Pa											1.4						
Parkersburg, W. Va											5.0						
Columbus, Ohio		8.0	8.0	5.0	0.5	2.5			4.0	6.0	8.0	6.0					
Memphis, Tenn										0.5	1.0						
Fort Smith, Ark											9.0						
Little Rock, Ark											5.0						
New Orleans, La											2.0						
Brattleboro, Vt	2.0	2.5	6.5	*	8.0	10.0	9.0	11.0	13.0	17.0	18.5	18.0	17.5	14.0	15.0	*	1.5
Concord, Mass	2.0	3.0	*	*	11.0	*	*	12.0	15.0	16.0	*	22.0	17.0	10.0	7.0	7.0	6.0
Albany, N. Y			5.0	3.0	6.5	1.0	6.0	8.0	10.0	9.5	11.0	9.0	8.5				
New Brunswick, N. J					1.5					5.0	8.0	13.0					
Harrisburg, Pa											12.0	12.0					
Lynchburg, Va											5.0						
Richmond, Va											6.0	2.0					
Columbia, S. C											2.0						

* Missing.

The highest and lowest water, mean stage, and monthly range at 130 river stations are given in the accompanying table. Hydrographs for typical points on seven principal rivers are shown on Chart V. The stations selected for charting are: St. Louis, Cairo, Memphis, and Vicksburg, on the Mississippi; Cincinnati, on the Ohio; Nashville, on the Cumberland; Johnsonville, on the Tennessee; Kansas City, on the Missouri; Little Rock, on the Arkansas; and Shreveport, on the Red.—*H. C. Frankenfield, Forecast Official.*

Heights of rivers referred to zeros of gauges, March, 1899.

Stations.	Distance to mouth of river.	Danger line on gauge.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.		
Mississippi River.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
St. Paul, Minn	1,957	14	Frozen					
Reads Landing, Minn	1,887	12	−0.1	1-4, 12, 13	−0.5	18-30	−0.3	0.4
La Crosse, Wis	1,822	12	Frozen					
North McGregor, Iowa	1,762	18	7.6	16, 17	3.1	10	4.7	4.5
Dubuque, Iowa[1]	1,702	15	8.0	14, 15	3.2	31	6.1	4.8
Leclaire, Iowa[2]	1,612	10	4.0	14,15,19,20	1.0	30, 31	2.9	3.0
Davenport, Iowa[2]	1,596	15	6.8	20	2.5	31	4.8	4.3
Muscatine, Iowa	1,565	16	8.0	21	3.4	31	5.3	4.6
Galland, Iowa	1,475	8	4.8	19, 22	1.9	31	3.3	2.9
Keokuk, Iowa[3]	1,466	14	8.5	19	3.0	30	5.8	5.5
Hannibal, Mo.[4]	1,405	17	10.4	20	3.2	8, 9	6.5	7.2
Grafton, Ill	1,307	23	14.5	21, 22	8.0	3	10.6	6.5
St. Louis, Mo	1,264	30	19.8	22	10.7	9, 10	14.5	9.1
Chester, Ill	1,189	36	15.6	22, 23	8.1	10, 11	11.3	7.5
Memphis, Tenn	843	33	35.3	30, 31	22.0	1	32.1	13.3
Helena, Ark	767	42	45.5	31	28.8	1	40.9	16.7
Arkansas City, Ark	635	42	46.5	31	29.7	1	40.8	16.8
Greenville, Miss	595	42	40.1	30	24.8	1	34.5	15.3
Vicksburg, Miss	474	45	44.8	31	29.8	2	38.8	15.0
New Orleans, La	108	16	15.5	30, 31	11.2	7	13.7	4.3
Missouri River.								
Bismarck, N. Dak	1,201	14	10.9	22	4.6	1	7.9	6.3
Pierre, S. Dak	1,006	14	Frozen					
Sioux City, Iowa	676	19	Frozen					
Omaha, Nebr	561	18	*					
Plattsmouth, Nebr	533	17	6.7	14	4.0	27	5.3	2.7
St. Joseph, Mo	373	10	3.3	31	0.8	10	2.1	2.5
Kansas City, Mo	280	21	10.7	18	6.0	6	8.3	4.7
Boonville, Mo	191	20	11.9	19	6.8	6, 30	8.7	5.1
Hermann, Mo	95	24	12.9	20	7.2	29, 30	9.4	5.7
Des Moines River.								
Des Moines, Iowa[5]	150	19	4.1	18	3.1	11, 12	3.7	1.0
Illinois River.								
Peoria, Ill	135	14	15.1	22	11.4	1	14.1	3.7
Beardstown, Ill	70	12	15.1	6, 10-14	12.8	1	14.7	2.3
Osage River.								
Bagnell, Mo	70	28	14.0	1	3.8	29	7.1	10.2
Gasconade River.								
Arlington, Mo	58	16	3.0	1	−0.3	16, 17	0.7	3.3
Youghiogheny River.								
Confluence, Pa	59	10	8.5	5, 29	3.4	18	5.0	5.1
West Newton, Pa	15	23	11.5	29	2.6	18	4.7	8.9

Heights of rivers referred to zeros of gauges—Continued.

Stations.	Distance to mouth of river.	Danger line on gauge.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.		
Allegheny River.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
Warren, Pa	177	7	6.5	6	2.3	12, 13	3.7	4.2
Oil City, Pa	123	13	7.2	6	2.5	13	4.1	4.7
Parkers Landing, Pa	73	20	8.8	6	3.4	12	5.3	5.4
Monongahela River.								
Weston, W. Va	161	18	13.0	5	0.0	15-18	1.7	13.0
Fairmont, W. Va	119	25	16.0	29	1.7	18	5.2	14.3
Greensboro, Pa	81	18	22.0	6	8.5	18	11.2	13.5
Lock No. 4, Pa	40	28	26.9	6	8.9	18, 19	13.3	18.0
Conemaugh River.								
Johnstown, Pa	64	7	5.6	6	2.4	27	3.3	3.2
Red Bank Creek.								
Brookville, Pa	35	8	2.8	5	1.0	10-18	1.4	1.8
Beaver River.								
Ellwood Junction, Pa	10	14	3.3	5	1.4	17-19	2.0	1.9
Great Kanawha River.								
Charleston, W. Va	61	30	41.5	6	7.0	15, 16	13.6	34.5
New River.								
Hinton, W. Va	95	14	13.8	5	3.9	14, 15, 28	6.0	9.9
Cheat River.								
Rowlesburg, W. Va	36	14	10.0	5	3.5	{13-15, 25-28}	4.3	6.5
Ohio River.								
Pittsburg, Pa	966	22	22.0	6	6.6	16-19	10.8	15.4
Davis Island Dam, Pa	960	25	17.9	30	8.2	17	11.4	9.7
Wheeling, W. Va	875	36	28.2	7	9.7	17	15.9	18.5
Parkersburg, W. Va	785	36	28.0	7	10.7	18	19.0	17.3
Point Pleasant, W. Va	703	39	47.2	7	15.5	17	27.8	31.7
Catlettsburg, Ky	651	50	56.3	7	20.0	17	34.6	36.3
Portsmouth, Ohio	612	50	55.8	7	21.2	17, 18	36.0	34.6
Cincinnati, Ohio	499	50	57.4	8	24.2	18	40.1	33.2
Louisville, Ky	367	28	32.8	10	9.9	18	18.6	22.9
Evansville, Ind	184	35	42.7	12	31.7	21	36.8	11.0
Paducah, Ky	47	40	43.6	31	33.4	1	40.7	10.2
Cairo, Ill	1,073	45	46.2	30, 31	36.1	1	43.9	10.1
Muskingum River.								
Zanesville, Ohio	70	20	17.5	29	9.6	18	14.0	7.9
Miami River.								
Dayton, Ohio	69	18	5.7	6	2.7	16, 17	3.6	3.0
Wabash River.								
Mount Carmel, Ill	50	15	18.6	7, 28	13.8	14	16.8	4.8
Licking River.								
Falmouth, Ky	30	25	27.7	5	3.6	17, 18	10.8	24.1
Hiwassee River.								
Charleston, Tenn	18	22	27.6	20	3.9	13	11.1	23.7
Clinch River.								
Speers Ferry, Va	156	20	16.4	19	1.5	14	5.0	14.9
Clinton, Tenn	46	25	26.5	21	8.2	14	15.5	18.3
Tennessee River.								
Knoxville, Tenn	614	28	28.2	20	3.3	14	10.9	24.9
Kingston, Tenn	534	25	27.1	21	4.8	14	13.7	22.3
Chattanooga, Tenn	430	33	40.2	22	9.4	14	23.5	30.8
Bridgeport, Ala	390	24	28.0	23	8.2	13	18.4	19.8
Florence, Ala	230	16	25.2	20	10.9	14	18.2	14.3
Riverton, Ala		25	40.0	21, 22	17.5	14	29.5	22.5
Johnsonville, Tenn	94	21	39.7	1	22.8	9	30.5	16.9
Cumberland River.								
Burnside, Ky	434	50	57.5	5	6.5	14	21.7	51.0

Heights of rivers referred to zeros of gauges—Continued.

Stations.	Distance to mouth of river.	Danger line on gauge.	Highest water. Height.	Highest water. Date.	Lowest water. Height.	Lowest water. Date.	Mean stage.	Monthly range.
Cumberland River—Con.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
Carthage, Tenn	257	30	39.0	10	9.7	14	26.3	29.3
Nashville, Tenn	175	40	39.0	11	21.0	16	31.8	18.0
Arkansas River.								
Wichita, Kans	720	10	......	......	......	......	......	......
Webbers Falls, Ind. Ter.	......	23	9.5	1	3.0	31	4.6	6.5
Fort Smith, Ark	345	22	11.5	1	4.1	14	6.0	7.4
Dardanelle, Ark	250	21	11.0	2	3.4	17	6.0	7.6
Little Rock, Ark	170	23	12.2	4	4.9	17, 18	7.9	7.3
White River.								
Newport, Ark	150	26	16.8	1	9.4	17	12.9	7.4
Yazoo River.								
Yazoo City, Miss	80	25	25.2	31	17.1	3-5	21.2	8.1
Red River.								
Arthur City, Tex	688	27	6.1	22	4.3	7	4.7	1.8
Fulton, Ark	565	28	9.3	4	3.8	18-20	5.5	5.5
Shreveport, La	449	29	6.7	7	3.1	23, 24, 27, 31	4.3	3.6
Alexandria, La	139	33	12.3	20	6.2	7, 14	8.5	6.1
Ouachita River.								
Camden, Ark	340	39	18.6	2	7.3	30	11.3	11.3
Monroe, La	100	40	29.2	24, 25	23.4	13	26.4	5.8
Atchafalaya Bayou.								
Melville, La	100†	31	32.2	31	27.7	5, 6	30.1	4.5
Susquehanna River.								
Wilkesbarre, Pa	178	14	14.0	6	4.7	31	8.7	9.3
Harrisburg, Pa	70	17	13.0	7	5.8	12, 13	7.9	7.2
W. Br. of Susquehanna.								
Williamsport, Pa	35	20	13.1	6	5.4	11	7.5	7.7
Juniata River.								
Huntingdon, Pa	80	24	......	......	......	......	......	......
Potomac River.								
Harpers Ferry, W. Va	170	16	15.5	6	3.7	27	6.6	11.8
James River.								
Lynchburg, Va	257	18	19.0	5	2.6	28	5.1	16.4
Richmond, Va	110	12	20.5	7	1.9	28, 29	5.7	18.6
Roanoke River.								
Clarksville, Va	155	12	17.0	21	3.6	14	7.1	13.4
Weldon, N. C.[6]	90	27	......	......	......	......	......	......
Cape Fear River.								
Fayetteville, N. C	100	38	42.0	17	8.7	14	22.1	33.3
Lumber River.								
Fairbluff, N. C	10	6	6.8	8.9	5.1	24-26	5.9	1.7
Edisto River.								
Edisto, S. C	75	6	5.7	7	4.7	19	5.2	1.0
Pedee River.								
Cheraw, S. C	145	27	32.7	22	7.0	14	19.7	25.7

Heights of rivers referred to zeros of gauges—Continued.

Stations.	Distance to mouth of river.	Danger line on gauge.	Highest water. Height.	Highest water. Date.	Lowest water. Height.	Lowest water. Date.	Mean stage.	Monthly range.
Black River.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
Kingstree, S. C	60	12	10.0	1	6.5	23-29	7.1	3.5
Lynch Creek.								
Effingham, S. C	35	12	15.9	4	8.1	20	10.6	7.8
Santee River.								
St. Stephens, S. C	50	12	12.2	8, 28	8.3	19	10.1	3.9
Congaree River.								
Columbia, S. C	37	15	14.0	1	1.8	13, 14	5,3	12.2
Wateree River.								
Camden, S. C	45	24	28.5	21	7.4	14	18.2	21.1
Waccamaw River.								
Conway, S. C	40	7	8.6	1-3	4.8	26, 27	6.7	3.8
Savannah River.								
Calhoun Falls, S. C[5]	......	......	13.6	16	3.9	12	5.7	9.7
Augusta, Ga	130	32	28.5	1	11.0	15	16.0	17.5
Broad River.								
Carlton, Ga	......	......	13.3	16	3.3	11-13	4.6	10.0
Flint River.								
Albany, Ga	80	20	15.9	4, 5	7.8	15	11.2	8.1
Chatahoochee River.								
West Point, Ga	......	20	14.5	1	4.8	12	7.6	9.7
Eufaula, Ala	90	30	29.0	1	8.0	14, 15	14.7	21.0
Coosa River.								
Rome, Ga	225	30	29.2	17	4.5	13	9.9	24.7
Gadsden, Ala	144	18	24.8	21	5.8	13	13.3	19.0
Alabama River.								
Montgomery, Ala	265	35	35.2	2	9.8	13	24.2	25.4
Selma, Ala	212	35	38.8	3	13.9	13	28.3	24.9
Tombigbee River.								
Columbus, Miss	285	33	31.4	17	1.4	13	13.5	30.0
Demopolis, Ala	155	35	59.3	24	19.9	13	43.4	39.4
Black Warrior River.								
Tuscaloosa, Ala	90	38	60.3	17	10.0	13	30.1	50.3
Columbia River.								
Umatilla, Oreg	270	25	4.6	27-29	2.0	17, 18	3.0	2.6
The Dalles, Oreg	166	40	6.7	30	3.7	19	4,8	3.0
Willamette River.								
Albany, Oreg	99	20	23.0	3	7.5	31	10.6	15.5
Portland, Oreg	10	15	13.2	4	4.1	22	7.1	9.1
Sacramento River.								
Red Bluff, Cal	241	23	20.4	25	2.3	1	7.0	18.1
Sacramento, Cal	70	25	24.1	31	11.6	1	16.3	12.5

* Frozen until 25th. † Distance to Gulf of Mexico. [1] Record for 19 days. [2] Record for 18 days. [3] Record for 21 days. [4] Record for 30 days. [5] Record for 28 days. [6] No gauge.

CLIMATE AND CROP SERVICE.

By JAMES BERRY, Chief of Climate and Crop Service Division.

The following extracts relating to the general weather conditions in the several States and Territories are taken from the monthly reports of the respective sections of the Climate and Crop Service. The name of the section director is given after each summary.

Rainfall is expressed in inches.

Alabama.—The mean temperature was 55.6°, or 1.0° above normal; the highest was 91°, at Union on the 26th and at Pineapple on the 27th, and the lowest, 4°, at Decatur, Oneonto, and Valleyhead on the 7th. The average precipitation was 6.68, or 1.08 above normal; the greatest monthly amount, 15.60, occurred at Maplegrove, and the least, 1.79 at Clanton.—*F. P. Chaffee.*

Arizona.—The mean temperature was 54.4°, or 1.8° below normal; the highest was 94°, at Parker on the 7th and at Blaisdell on the 24th, and the lowest, 6°, at Flagstaff on the 14th. The average precipitation was 0.16, or 0.62 below normal; the greatest monthly amount, 1.16, occurred at Oracle, while none fell at a number of stations.—*W. G. Burns.*

Arkansas.—The mean temperature was 50.6°, or 0.4° below normal; the highest was 87°, at Prescott on the 22d, and the lowest, 1°, at Jonesboro and Pond on the 6th. The average precipitation was 2.97, or 2.21 below normal; the greatest monthly amount, 8.40, occurred at Osceola, and the least, 1.09, at Texarkana.—*E. B. Richards.*

California.—The mean temperature was 51.2°, or 1.0° below normal; the highest was 103°, at Elsinore on the 6th, and the lowest, 4° below zero, at Boca, on the 13th. The average precipitation was 6.10, or 3.13 above normal; the greatest monthly amount, 26.31, occurred at Bowmans Dam, while none fell at several stations.—*G. H. Willson.*

Colorado.—The mean temperature was 33.0°, or 1.5° below normal; the highest was 85°, at Lamar on the 8th and 24th, and the lowest, 25° below zero, at Moraine on the 27th. The average precipitation was 1.64, or 0.67 above normal; the greatest monthly amount, 16.59, occurred at Ruby, and the least, trace, at Saguache.—*F. H. Brandenburg.*

Florida.—The mean temperature was 66.3°, or nearly normal; the highest was 93°, at Plant City on the 27th, and the lowest, 23°, at De Funiak Springs on the 8th. The average precipitation was 1.96, or about 1.00 below normal; the greatest monthly amount, 7.61, occurred at Wausau, and the least, 0.14, at Key West.—*A. J. Mitchell.*

Georgia.—The mean temperature was 55.1°, or 1.9° above normal; the highest was 92°, at Columbus on the 28th, and the lowest, 3° below zero, at Diamond on the 7th. The average precipitation was 4.81, or 1.85 below normal; the greatest monthly amount, 10.85, occurred at Ramsey, and the least, 1.00, at Brag.—*J. B. Marbury.*

Indiana.—The mean temperature was 37.3°, or 1.3° below normal; the highest was 76°, at Peru on the 11th, and the lowest, 3° below zero, at Rockville and Syracuse on the 7th. The average precipitation was 4.42, or 0.66 above normal; the greatest monthly amount, 7.83, occurred at Crawfordsville, and the least, 0.95, at Valparaiso.—*C. F. R. Wappenhans.*

Iowa.—The mean temperature was 23.0°, or about 10.0° below normal; the highest was 75°, at Mount Pleasant on the 10th and 11th, and the lowest, 16° below zero, at Charles City and Cresco on the 7th. The average precipitation was 1.62, or nearly normal; the greatest monthly amount, 5.90, occurred at Ridgeway, and the least, 0.37, at Monticello.—*J. R. Sage, Director; G. M. Chappel, Assistant.*

Kansas.—The mean temperature was 37.3°, or 4.1° below normal; the highest was 87°, at Englewood on the 8th, and the lowest, 1° below zero, at Morantown on the 6th. The average precipitation was 1.90, or 0.26 above normal; the greatest monthly amount, 6.22, occurred at Centropolis, and the least, 0.20, at Winona—*T. B. Jennings.*

Kentucky.—The mean temperature was 43.9° or 2.2° below normal; the highest was 80°, at Russellville on the 3d, and the lowest, 3° below zero, at Alpha on the 7th. The average precipitation was 8.10, or 2.14 above normal; the greatest monthly amount, 12.80, occurred at Mount Herman, and the least, 5.36, at Canton.—*H. B. Hersey.*

Louisiana.—The mean temperature was 61.3°, or 0.8° below normal; the highest was 91°, at Wallace on the 27th, and the lowest, 25°, at Plaquemine on the 6th, at Robeline on the 7th, and at Plain Dealing on 29th. The average precipitation was 3.02, or 1.80 below normal; the

greatest monthly amount, 8.81, occurred at Ruston, and the least, 0.26, at Houma.—*W. T. Blythe.*

Maryland and Delaware.—The mean temperature was 41.4°, or 0.3° below normal; the highest was 77°, at Hancock, Md., on the 12th, and the lowest, 1°, at Sunnyside, Md., on the 7th. The average precipitation was 4.92, or 1.50 above normal; the greatest monthly amount, 7.42, occurred at Sunnyside, Md., and the least, 2.44, at Boonsboro, Md.—*F. J. Walz.*

Michigan.—The mean temperature was 23.6°, or 4.9° below normal; the highest was 68°, at Mount Clemens on the 11th, and the lowest, 21° below zero, at Sidnaw on the 11th, at Wetmore on the 16th, and at Lathrop on the 17th. The average precipitation was 3.29, or 1.24 above normal; the greatest monthly amount, 6.72, occurred at Berrien Springs, and the least, 1.08, at Calumet. The average snowfall, 22.5 inches, is 9.8 inches greater than the snowfall for any previous March of which there is record.—*C. F. Schneider.*

Minnesota.—The mean temperature was 14.7°, or about 9.0° below normal; the highest was 52°, at Moorhead on the 8th, and the lowest, 38° below zero, at Pokegama on the 1st. The average precipitation was 1.68, or about normal; the greatest monthly amount, 6.51, occurred at New Ulm, and the least, 0.30, at Morris.—*T. S. Outram.*

Mississippi.—The mean temperature was 56.6°, or about normal; the highest was 90°, at Yazoo City on the 27th, and the lowest, 9°, at Booneville on the 6th and at Okolona on the 8th. The average precipitation was 5.78, or 0.37 below normal; the greatest monthly amount, 11.67, occurred at Biloxi, and the least, 2.05, at Hattiesburg.—*H. E. Wilkinson.*

Missouri.—The mean temperature was 37.3°, or 5.0° below normal; the highest was 78°, at Wylie on the 9th, and the lowest, 8° below zero, at McCune Station on the 7th. The average precipitation was 2.93, or 0.56 below normal; the greatest monthly amount, 7.03, occurred at Sublett, and the least, 1.09, at Mineralsprings.—*A. E. Hackett.*

Montana.—The mean temperature was 21.9°, or 3.7° below normal; the highest was 68°, at Kalispel on the 26th, and the lowest, 31° below zero, at Glasgow on the 22d. The average precipitation was 1.14, or 0.18 above normal; the greatest monthly amount, 3.00, occurred at Fort Yellowstone National Park, and the least, 0.25, at Kalispel—*E. J. Glass.*

Nebraska.—The mean temperature was 26.8°, or about 7.0° below normal; the highest was 82°, at Alma and Beaver City on the 8th, and the lowest, 15° below zero, at Kimball on the 26th. The average precipitation was 0.92, or 0.23 below normal; the greatest monthly amount, 3.40, occurred at Bassett and Rulo, and the least, trace, at Callaway.—*G. A. Loveland.*

Nevada.—The mean temperature was 38.6°, or about normal; the highest was 79°, at Panaca on the 24th, and the lowest, 4°, at Empire Ranch on the 13th. The average precipitation was 1.83, or 0.76 above normal; the greatest monthly amount, 8.51, occurred at Lewers Ranch, while none fell at Las Vegas.—*J. H. Smith.*

New England.—The mean temperature was 29.9°, or 1.1° below normal; the highest was 65°, at Boston, Mass., on the 12th, and the lowest, 19° below zero, at Berlin Mills, N. H., on the 18th. The average precipitation was 6.43, or 2.91 above normal; the greatest monthly amount, 9.67, occurred at Kingston, R. I., and the least, 3.45, at Cornwall, Vt.—*J. W. Smith.*

New Jersey.—The mean temperature was 38.6°, or 1.4° above normal; the highest was 73°, at Beverly, Bridgeton, and Port Norris on the 12th, and the lowest, 13°, at Chester on the 21st. The average precipitation was 6.54, or 2.57 above normal; the greatest monthly amount, 9.58, occurred at Lebanon, and the least, 3.45, at Cape May City.—*E. W. McGann.*

New Mexico.—The mean temperature was 45.2°, or 0.6° above normal; the highest was 92°, at Eddy on the 22d, 23d, and 24th, and the lowest, 10° below zero, at Fort Union on the 27th. The average precipitation was 0.50, or 0.07 below normal; the greatest monthly amount, 1.62, occurred at Monero, and the least, trace, at Rincon.—*R. M. Hardinge.*

New York.—The mean temperature was 30.1°, or 0.3° below normal; the highest was 72°, at Nunda on the 12th, and the lowest, 12° below zero, at North Lake on the 17th. The average precipitation was 4.65, or 1.31 above normal; the greatest monthly amount, 11.24, occurred at Kings Station, and the least, 1.03, at Hemlock Lake.—*R. G. Allen.*

North Carolina.—The mean temperature was 50.0°, or 1.5° above normal; the highest was 81°, at Sloan on the 4th, and the lowest, 7° below zero, at Highlands on the 7th. The average precipitation was 7.04, or 2.40 above normal; the greatest monthly amount, 14.24, occurred at Highlands, and the least, 1.01, at Wilmington.—*C. F. von Herrmann.*

North Dakota.—The mean temperature was 7.8°, or 12.5° below normal; the highest was 72°, at Berthold Agency on the 8th, and the lowest, 30° below zero, at Milton and Woodbridge on the 6th. The average precipitation was 1.06, or 0.10 above normal; the greatest monthly amount, 2.99, occurred at Fullerton, and the least, 0.11, at Woodbridge.—*B. H. Bronson.*

Ohio.—The mean temperature was 36.9°, or 1.6° below normal; the highest was 76°, at Portsmouth on the 11th, and the lowest, zero, at Bethany on the 7th. The average precipitation was 4.66, or 1.21 above normal; the greatest monthly amount, 7.70, occurred at Hanging Rock, and the least, 2.31, at Bladensburg.—*J. Warren Smith.*

Oregon.—The mean temperature was 42.9°, or 1.6° below normal; the highest was 75°, at Vernonia on the 5th, and the lowest, 6°, at Joseph on the 14th. The average precipitation was 4.03, or 0.25 below normal; the greatest monthly amount, 13.28, occurred at Government Camp, and the least, 0.23, at Arlington.—*B. S. Pague.*

Pennsylvania.—The mean temperature was 36.3°, or 0.6° above normal; the highest was 75°, at Confluence on the 11th and at Aqueduct on the 12th, and the lowest, 3°, at Smethport on the 21st. The average precipitation was 4.87, or 1.44 above normal; the greatest monthly amount, 10.30, occurred at Hawthorn, and the least, 1.91, at Shinglehouse.—*T. F. Townsend.*

Texas.—The mean temperature for the State, determined by comparison of 46 stations distributed throughout the State, was 1.4° above the normal; there was a slight deficiency over the northwestern portion of the State, while there was a general excess or nearly normal conditions elsewhere; the highest was 107°, at Llano on the 25th, and the lowest, 1° below zero, at Tulia on the 28th. The average precipitation, determined by comparison of 52 stations distributed throughout the State, was 1.69 below the normal; there was a general deficiency, ranging from 1.00 to 4.78 over north, central, southwest, and east Texas and the coast district, with the greatest in the vicinity of Sulphur Springs; there was only a slight deficiency over west Texas and the panhandle, where the normal rainfall for the month does not amount to as much as 1.00; the greatest monthly amount, 2.35, occurred at Huntsville, while none fell at a number of stations.—*I. M. Cline.*

Utah.—The mean temperature was 38.5°; the highest was 84°, at St. George on the 7th, and the lowest, 3° below zero, at Woodruff on the 14th. The average precipitation was 2.46; the greatest monthly amount, 5.40, occurred at Manti, and the least, 0.10, at Tropic.—*L. H. Murdoch.*

Tennessee.—The mean temperature was 47.8°, or about normal; the highest was 85°, at Madison on the 3d, and the lowest, 8° below zero, at Silverlake on the 8th. The average precipitation was 8.12, or 2.51 above normal; the greatest monthly amount, 17.06, occurred at Benton, and the least, 3.04, at Memphis.—*H. C. Bate.*

Virginia.—The mean temperature was 44.9°, or slightly above normal; the highest was 78°, at Williamsburg on the 11th, and the lowest, 2°, at Monterey on the 7th. The average precipitation was 6.37 or 2.61 above normal; the greatest monthly amount, 11.50, occurred at Bigstone Gap, and the least, 3.47, at Woodstock.—*E. A. Evans.*

Wisconsin.—The mean temperature was 20.1°, or 7.8 below normal; the highest was 60°, at Delavan, Milwaukee, Racine, and Sharon on the 11th; the lowest was 27° below zero, at Butternut on the 1st. The average precipitation was 2.39, or 0.25 above normal; the greatest monthly amount, 5.20, occurred at Spooner, and the least, 0.28, at Beloit.—*W. M. Wilson.*

Wyoming.—The mean temperature was 25.0°, or 3.3 below normal; the highest was 67°, at Fort Laramie on the 8th, and the lowest 23° below zero, at Centennial on the 27th. The average precipitation was 1.86, or 0 33 above normal; the greatest monthly amount, 6.00, occurred at Centennial, and the least, 0.31, at Cody.—*W. S. Palmer.*

SPECIAL CONTRIBUTIONS.

EXPERIMENTS IN WEATHER PREDICTION.

By WM A. EDDY, Bayonne, N. J.

The kite weather predictions that I have been making at Bayonne, N. J., and which extend back to 1891 (see American Meteorological Journal, July 1891, Vol. VIII, pp. 122–125), deal with a condition of the air at a height of only a few hundred feet. I have left the investigation of greater altitudes to the United States Weather Bureau and the Blue Hill Observatory.

The Weather Bureau forecasts, based on observations at surface stations, have a much greater range and variety and extend over a greater period of time than mine, besides including deductions from a vast organization of stations with studies involving both hemispheres, or the entire circuit of the globe. It is obvious that the Weather Bureau runs a much greater risk than I in many cases; the reason of this, as I believe, is because the conditions forecasted have neither arrived aloft nor at the earth. But the most striking difference between the few predictions which I have made and

the forecasts of the Weather Bureau, is that I have been dealing with conditions that actually exist aloft but not at the earth's surface. The only certainty remaining in my case is that due to the possible failure of those conditions to descend to the earth. I believe that predictions founded on observations taken below the 1,000-foot level will be found to cover a shorter period of time, say twelve hours, than those based on data obtained by means of kites at a height of 10,000 feet, since the Blue Hill observations show that high-level conditions are slower in reaching the earth. The remaining question is as to whether or not changes of wind and the disturbance caused by the sudden formation of anticyclones and cyclones may cause the conditions at the 10,000-foot level to change without affecting the surface air. Owing to my many experiments relating to other questions than weather forecasts I have not had time to properly search out this element of uncertainty, if it exists, in the Blue Hill observations and at Bayonne.

The astonishing fact is beginning to appear that perhaps the most important changes take place within less than 1,000 feet of the earth. In a paper by Mr. A. Lawrence Rotch, Director of Blue Hill Observatory (see Quarterly Journal of the Royal Meteorological Society, Vol. XXIV, No. 108, October, 1898, p. 256) it is said that before a warm wave there is—

> During the day a decrease of temperature at the adiabatic rate from the ground up to more than 1,000 feet, then a sudden rise of temperature, amounting perhaps to 15°, followed by a slow fall.

But at the approach of a cold wave he says there is—

> A rapid fall of temperature which exceeds the adiabatic rate up to above 1,000 feet, and above that it falls at the adiabatic rate up to 3,000 feet or higher.

Again, he says, p. 257:

> After the cold wave has passed and with the coming of a southeast storm the temperature rises rapidly up to a height of 1,000 or 2,000 feet and then slowly falls.

These observations made by Mr. Rotch exactly agree with mine, but I must add the following facts observed recently at Bayonne:

I have found it convenient, instead of using the adiabatic rate of 1° for each 180 feet of ascent to use 1° for every 250 feet of ascent, for the rate of cooling is usually slower for the first thousand feet because of the proximity of the earth, especially in summer. I find that abnormal warmth, at the height of a few hundred feet is apt to precede a cold wave, coming in on the heels of a storm. On one occasion in the autumn the air was 4° warmer than the surface at the height of 300 feet. The steel index on the right-hand side of the (Six's) thermometer could not have been jolted upward. The result was a cold wave the following morning. Meantime, I did not dare to predict. On February 8, 1899, at 8 p. m., when I encountered somewhat similar abnormalities, temperature at the earth rising and falling, but with a rapid fall as the kite-sustained thermometer went upward, I predicted a cold wave for the 9th; the prediction was published in the New York morning Sun of February 9; on the previous afternoon the Weather Bureau had forecasted the same conditions; my local observation was, like all my observations, intended as auxiliary to those of the Weather Bureau. The cold wave lasted a week and broke the record at New York.

Great care is called for in making kite predictions of warm waves founded on warmer air aloft, in case a storm is just passing off; because then the intermingling air currents indicate a cold instead of a warm wave. I think it is necessary in making predictions founded on warmer air aloft, to send the thermometer as far as possible beyond the 1,000-foot level.

At the beginning of a cold wave on February 4, 1891, my kite thermometer recorded a fall of 5° for a height of 600 feet. In the above-mentioned article in the American Meteorological Journal for July, 1891, I said, in discussing this fact:

> It was an instance illustrating the fact that a cold wave could be detected promptly through either kite or balloon observations.

While I am preceded in kite thermometer experiments by Wilson and Melville, 1749, in Scotland, and by Birt in Englang in 1847, yet I seem to have been the first to declare in public that the kite could be used for weather prediction and the first to make a positive kite prediction in the public press. I shall continue to experiment regarding some untried problems relative to temperature, snow, hail, sleet, rain, and thunder showers, but in the main I shall turn to other questions while my thermometer ascensions are and will be far surpassed by the wonderful achievements at Blue Hill, Washington, and elsewhere.

OBSERVATIONS AT RIVAS, NICARAGUA.

The records contributed for many years by Dr. Earl Flint, at Rivas, Nicaragua, include barometric readings. His present station is at 11° 26′ N., 85° 47′ W. The observations at 7:17 a. m., local time are simultaneous with Greenwich 1 p. m. The altitude of his barometer is 36 meters above sea level, but until the barometer has been compared with a standard it seems hardly necessary to publish the daily readings. The wind force is recorded on the Beaufort scale, 0–12. When cloudiness is less than $\frac{1}{10}$, the letter "F," or "Few," is recorded.

This station is situated on the western shore of Lake Nicaragua, not far from the eastern end of the western division of the Nicaragua Canal. The volcano Ometepe, on an island in Lake Nicaragua, is about 10 miles northeast of the station. Mr. Flint's records occasionally mention the presence of clouds in the early morning on the summit of this mountain.

Observations at Rivas, Nicaragua, February, 1899.

OBSERVATIONS AT 7:17 A. M. LOCAL (8 A. M. EASTERN STANDARD) TIME.

Date.	Temperature.		Wind.		Upper clouds.			Lower clouds.			Daily rainfall.
	Air.	Dew-point.	Direction.	Force.	Kind.	Amount.	Direction from.	Kind.	Amount.	Direction from.	
	°	°									
1	76	70	ne.	1				k.	5	ne.	0.00
2	75	71	e.	2-3				k.	1	e.	0.02
3	75.5	70	ne.	2				k.*	Few	ne.	0.00
4	76	70	ne.	2				k.	Few	ne.	0.00
5	76	70	ne.	1				k.	3	ne.	0.00
6	75.5	71	ne.	1				k.	1	ne.	0.00
7	74.5	71	se.	0				k.	5	se.	0.00
8	72	69	sw.	0				ak. k.	2 2	nw. s.w.	T.
9	74	70	se.	2	cs.	1		ks.	8	se.	0.52
10	74	71	se.	1				k.*			0.00
11	76	72	se.	1				ks.,ak.	2	se.	0.00
12	77	73	se.	1				k.	10	se.	0.33
13	76	70	se.	2-3	cs.,ck.	9	se.,s.	k.		se.	0.00
14	69	62	se.	3-4				ak.	3	se.	0.00
15	73	67	e.	3				f.k.	2	e.	0.00
16	74	72	se.	0	cs.	5	se.	k.			0.00
17	76	73	se.	1				k.	10	se.	0.69
18	75	72	ne.	1	ck.	Few	nw.	k.	1	ne.	0.02
19	76	71	ne.	2				k.	1	ne.	0.12
20	75	71	ne.	1	ck.	5	se.	k.	1	ne.	0.00
21	77	73	se.	1				k.	Few	se.	T.
22	75.5	71	ne.	1				k.*	Few	ne.	0.00
23	76.5	72	ne.	1				k.	1	ne.	0.00
24	77	70	ne.	1				k.	9	ne.	0.00
25	75.5	71	ne.	2	ck.	1	se.	k.	5	se.	0.00
26	76	71	ne.	1				k.	Few	ne.	0.00
27	76.5	72	ne.	1	cs.		sw.	k.	10	ne.	0.00
28	74	68	ne.	2				k.	9	ne.	T.
Sums											1.90
Means	75.5										

*On Ometepe.

OBSERVATIONS AT 8 P. M. EASTERN STANDARD TIME, (7:17 P. M. LOCAL.)

Date.	Temperature. Air.	Temperature. Dew-point.	Wind. Direction.	Wind. Force.	Upper clouds. Kind	Upper clouds. Amount.	Upper clouds. Direction from.	Lower clouds. Kind.	Lower clouds. Amount.	Lower clouds. Direction from.
	°	°								
1	78	72	ne.	2		0				
2	79	69	ne.	2-3		0				
3	79.5	72	ne.	1		0				
4	79	73	ne.	2		0				
5	79	73	ne.	1				ks.	Few	ne.
6	79	72	se.	0				ks.	10	?
7	79	74	w.	0.5		0			0	
8	78.5	74	se.	0		0			0	
9	77	71	ne.	2	cs.	10	ne.			
10	79	73	se.	0.5		0		k.*		
11	79	73	se.	1		0		ak.	Few	
12	79	73	se.	1				k.	10	se.
13	74	65	e.	3-4	c.	1	e.			
14	75	68	se.	2				ak.	4	se.
15	77	72	se.	2				d.k.	5	se.
16	78	72	se.	1				f.k.	1	se.
17	76	73	se.	1				ak.	10	se.
18	77.5	73	e.	2	ck.	8	e.			
19	77	73	ne.	1				ak.	9	ne.
20	79	73	ne.	1				ak.	10	ne.
21	79	73	se.	2	ck.	5	se.			
22	80.5	75	se.	1				k.	3	se.
23	81	74	ne.	2				a.k.,k.	8	ne.
24	78	72	se.	2				k.	10	se.
25	80	73	se.	0	c.	Few	s.			
26	79	75	se.	1				f.k.	5	se.
27	79	73	ne.	3	ck.	Few	se.			
28	79	75	ne.	2				k.	10	ne.
Means	78.2									

*Cumuli on Ometepe.

The rainfall occurred as follows: 2d, sprinkle at 3 a. m.; 9th, rain at 3:15 and 9 a. m.; 12th, thunderstorm from 7 to 8 p. m.; 17th, sprinkle, 0.02 inch at 1 a. m., frequent showers reported at Tortuga, about 50 miles southeast of Rivas on the southwest shore of Lake Nicaragua; 18th, sprinkle at 5:45 p. m.; 19th, sprinkle, 0.10 p. m.; 21st, sprinkle at 1 p. m.

The barometric range for the month was 0.16. The lowest occurred on the 21st and the highest on the 14th. Cool waves occurred on the 9th and 14th. On the 8th calm and smoky with a light air from the southwest; a shower occurred 5 miles to the northward, and a sprinkle at Rivas; 9th, wind backed to northeast at 10 a. m.; 15th, phenomenal clouds from the south and southwest.

MEXICAN CLIMATOLOGICAL DATA.

Through the kind cooperation of Señor Mariano Bárcena, Director, and Señor José Zendejas, vice-director, of the Central Meteorologico-Magnetic Observatory, the monthly summaries of Mexican data are now communicated in manuscript, in advance of their publication in the *Boletin Mensual;* an abstract translated into English measures is here given in continuation of the similar tables published in the MONTHLY WEATHER REVIEW since 1896. The barometric means have not been reduced to standard gravity, but this correction will be given at some future date when the pressures are published on our Chart IV.

Mexican data for March, 1899.

Stations.	Altitude.	Mean barometer.	Temperature. Max.	Temperature. Min.	Temperature. Mean.	Relative humidity.	Precipitation.	Prevailing direction. Wind.	Prevailing direction. Cloud.
	Feet.	*Inch.*	° *F.*	° *F.*	° *F.*	%	*Inch.*		
Colima	1,600	28.28	91.8	53.8	74.7	59		sw.	sw.
Durango (Seminario)	6,243	24.02	93.2	34.2	62.2	24		sw.	e.
Guanajuato	6,640	23.69	87.3	42.3	65.3	38		sw.	sw, w, nw
Leon (Guanajuato)	5,934	24.28	86.5	33.8	64.2	27		s.	sw.
Mexico (Obs. Cent.)	7,472	23.04	80.4	38.3	61.9	44	0.06	nw.	sw.
Morelia (Seminario)	6,401	23.97	84.4	43.5	65.7	46	T	sw.	w.
Oaxaca	5,164	25.06	92.1	38.1	70.7	55	0.60	s.	sw.
Puebla (Col. Cat.)	7,112	23.34	83.5	30.6	64.8	59		ene.	ssw.
Tuxpan (Vera Cruz)	19	29.90	100.4	57.2	76.3	76	T.	e.	n.
Siloa	6,063	24.26	82.9	41.7	66.7	39		wnw.	w.
Zapotlan (Seminario)	5,078	25.10	88.7	44.6	69.4	65		sse.	wsw.

WEATHER FORECASTING IN HONGKONG.

By W. DOBERCK, Director of the Hongkong Observatory (dated February 17, 1899).

In the law of storms in the eastern seas it is explained that all the phenomena connected with typhoons are natural consequences of the barometric gradients, and that the steepness of these cause enormous rainfalls, and that these tend to increase the gradients till the rainfall ceases for lack of water vapor when the center of the typhoon enters dry land. These phenomena are not qualitatively different from those experienced in colder climates. Although the climates feel so extremely different, there is scarcely sufficient difference in temperature to cause any substantial difference in the laws governing the weather. This is most apparent when the extreme differences in temperature are expressed on the absolute scale beginning with absolute zero.

In the northeast monsoon the wind blows practically always from the northeast, east, or east-southeast, as pressure is relatively lowest to the south. In midwinter the lowest pressure lies to the south of the equator, and in spring and autumn it lies to the north of the equator, a trough-shaped depression lying between the northeast and southwest winds. On the contrary, in the southwest monsoon there is no southwest wind in Hongkong unless there happens to be a depression to the north of the observer. A permanent depression inland in northern China or Siberia does not exist.

During the northeast monsoon, when the center of an anticyclone moving along eastward between preceding and following cyclones, passes comparatively close to Hongkong the weather clears there. The latitude of the centers of the anticyclones is generally about 35°, and perhaps never as low as 27°. The time when the northeast wind is strongest is not when the center is just north of or nearest to Hongkong, but occurs usually when the center is past, because the high pressure spreads to the south and southeast, so that pressure continues rising along the south coast of China after the center is past.

When during the northeast monsoon a low pressure advances across north China and Korea it seldom causes southwest wind in Hongkong, but only calms or very light winds. At the same time southwest winds are frequently reported from Saigon and the southern Phillipines, apparently against the gradient. This is caused by local shallow low pressures over the land, which becomes intensely heated, owing to the absence of the usual northeast monsoon and owing to the clear sky and hot sunshine. Such southwest breezes must have a diurnal period like land and sea breezes, and they do not blow at sea except very near land.

Northers in Hongkong are just like northers in Texas. They occur with falling temperature after very hot days in winter and spring. In case of high barometric areas over north China, Korea, and Japan sometimes a V-shaped depression with isobars open toward the south is formed near Formosa. Such a depression develops into a cyclone moving toward Japan.

While the weather in Hongkong in winter depends upon the latitude in which the cyclones and anticyclones are crossing to the northward, it depends in summer upon the latitude of the troughs.

Mr. A. G. Figg, who officiates as weather forecaster in Hongkong, states that there appears to be a general agreement in recent years between droughts in India and droughts in Hongkong.

Before a period of foggy weather sets in we note an upper current from south or southwest above the east wind. Then fog occurs along the coast, which is cooler than the sea, with light (usually east) wind. With west wind the coast is not so cool, and therefore fog is not so likely to occur as with east wind or calm.

Thunderstorms occur when gradients disappear with change of gradient, for instance, occasionally, before a typhoon; when the weather is hot; and especially, when the wind is northwest and it is very hot inland in China. Mr. Figg has sometimes noted jumps in the barometer readings before as well as during thunderstorms. He states that when they approach from the landside there is very little rain, while if they come up from the seaside there is great rain.

SELENIUM AND ITS USE FOR THE MEASUREMENT OF SUNSHINE.

By N. ERNEST DORSEY, Ph.D., of Johns Hopkins University (dated April 17, 1899).

Owing to frequent inquiries as to the suitability of some form of the selenium cell as a continuous and exact sunshine recorder, it has been deemed advisable to publish in this REVIEW a short account of what is known in regard to the selenium cell, especially with respect to this use.

The fact that the resistance of selenium is changed by the action of light was first announced by Willoughby Smith in 1873. He wished to use selenium bars with platinum wire electrodes melted into their ends as high resistances to be used in connection with submarine cables. His assistant found that the resistances of these bars were very inconstant, and this variability was found to be due to the varying illumination of the bars. It was found that the decrease of resistance noticed when the bars were illuminated was due to the visible radiation, and appeared to be instantaneous. Smith suggested that this effect might possibly be explained by the fact that selenium conducts electricity only when in the crystalline condition, and that light favors crystallization.

Immediately upon the publication of Smith's paper Lieutenant Sale, and also the Earl of Rosse, repeated and verified Smith's observation. The latter suggested that this property of selenium might be used as a means of measuring the intensity of light, as he found that the decrease of resistance is almost proportional to the square root of the intensity of the illumination.

In 1875 Werner Siemens went over this work again and then undertook the study of the effect of the physical state of the selenium upon its sensitiveness to light. He found that by protracted heating of amorphous selenium at 210° C., or by cooling melted selenium to this temperature (at which, with a longer duration of it, the selenium passes into a coarsely granular, crystalline state), he obtained a modification of crystalline selenium which possesses and retains a considerably greater conductivity than otherwise. It is also far more sensitive, and the decrease of its resistance due to its exposure to light appeared to be constant. He constructed the first of the so-called selenium cells, which he describes as follows: "By fusing into coarsely granular selenium two flat spirals of wire at the distance of about one millimeter from each other, I produced an extraordinarily sensitive photometer." Obscure heat rays were without effect upon this cell, while diffused daylight doubled its conductivity, and direct sunlight increased its conductivity, at times, tenfold.

Prof. W. G. Adams and R. E. Day now undertook investigations on this subject and in 1877 they published in the Philosophical Transactions a long and exhaustive article on the subject. Besides obtaining results similar to those already described, they found that the resistance of the selenium cell generally decreased with an increase of the current through it, and depended upon the direction of the current. They also found that the cells became polarized on the passage of a current; that the change of resistance due to illumination depended upon the end illuminated; that when no current was passing through the cell the action of light on the cell could give rise to a current through it, but in regard to this latter property they say:

> It appears that three pieces of the same length, made from the same rod, and annealed together may, owing to some slight difference in molecular condition, be very different as to their relative sensitiveness to the action of light.

It was also observed that a slight heating produces a great increase in the resistance, which also changes very greatly with the time; they appear to anneal slowly.

In 1878 Sabine studied the resistance of the fused-in electrodes and found that it was very great and depended upon the direction, strength, and duration of the current passing through the cell.

In 1884 C. E. Fritts described a new form of the selenium cell which is much more sensitive than any of these others. He melts a thin layer of selenium upon a metal plate with which it will form a chemical combination at least sufficient to cause the selenium to adhere to it and make good electrical connection, the other surface of the selenium is covered with a transparent conductor, generally gold leaf, through which the current is passed into the selenium. Like other kinds of selenium cells the resistance of these depends upon the strength and direction of the current and the temperature and age of the cell.

In 1888 Uljanin investigated this subject and explained the observed phenomena much in the same way as Smith first suggested. He assumed that the annealed selenium consists of various allotropic forms of selenium, some of which are conductors and some are not, and the action of light is supposed to favor the change from one form to the other. He gives a good résumé of the work up to this time.

In a series of articles published in the Philosophical Magazine, from 1881 to 1895, Bidwell points out that all the properties of the selenium cells which have been so far discovered suggest that the conduction through these cells is electrolytic in character. The selenium is probably a nonconductor, and the current is carried by metallic selenides contained in the selenium. In support of this he finds that selenium which has never touched metals but has been annealed in glass has a much higher resistance than that annealed in the ordinary way; and, furthermore, its resistance is decreased by the addition of metallic selenides, so that it behaves like ordinary selenium. He also found that certain specimens of selenium which were entirely insensitive to light, were rendered very sensitive by the addition of selenides. And, finally, he succeeded in constructing a cell composed of sulphur and silver sulphide which behaved exactly like the selenium cell. His last article, published in the Proc. Phys. Soc. 13, 1894, pp. 552–579, and Phil. Mag. (5) 40, 1895, pp. 233–256, contains the best and most recent résumé of the entire subject.

From this we see that while selenium cells may be used for very rough determinations of the intensity of illumination, they are eminently unsuitable for any exact photometric work. Owing to the fact that the resistance varies with the strength and duration of the current, and with the temperature, and with the entire past history of the selenium, each cell would have to be carefully studied in order to obtain the coefficients of these various factors, and after this was done these coefficients would be correct for but a very short time, on account of the unknown and variable change of the resistance and electromotive force of the selenium cell with its age.

The best articles on this subject are as follows: Willoughby Smith, Nature, 5, 1873, pp. 303 and 361; Am. Jour. Science, (3) 5, 1873, p. 301. Lieutenant Sale, P. R. S., 21, 1873, p. 283; Pogg. Ann., 150, p. 333; Phil. Mag. (4) 47, 1874, p. 216; Earl of Ross, Phil. Mag. (4) 47, 1874, p. 161; Werner Siemens, Monatsberichten der kön. preuss. Akad. d. Wissenschaften zu Berlin, 1875, p. 280; Phil. Mag. (4) 50, p. 416; Pogg. Ann., 149, p. 140; W. S. Adams and R. E. Day, Phil. Trans., 167, 1877, pp. 313–349; Proc. Roy. Soc., vols. 23, 24, 25; Sabine, Phil. Mag. (5) 5, 1878, p. 401; Bell, Proc. A. A. A. S., 29, 1880;

Dr. James Moser, Pro. Phys. Soc. 4, 1881, p. 348; C. E. Fritts, Pro. A. A. A. S., 33, 1884, p. 97; Scientific American Supplement, June 6, 1885, p. 7854; Bidwell, Phil. Mag. (5) 5, 1881, p. 302; 15, 1883, p. 31; 13, 1882, p. 347; 40, 1895, pp. 233–256; Pro. Phys. Soc, 7, 1885, p. 129; 13, 1894, pp. 552–579; W. von Uljanin, Thesis published in Moscow, entitled *Ueber die bei der Beleuchtung entstehende Electromotorische Kraft im Selen;* Morize, Am. Met. Jour. vol. 2, p. 2.

OBSERVATIONS AT HONOLULU.

Through the kind cooperation of Mr. Curtis J. Lyons, Meteorologist to the Government Survey, the monthly report of meteorological conditions at Honolulu is now made nearly in accordance with the new form, No. 1040, and the arrangement of the columns, therefore, differs from those previously published.

Meteorological observations at Honolulu.

MARCH, 1899.

The station is at 21° 18′ N., 157° 50′ W.

Pressure is corrected for temperature and reduced to sea level, and the gravity correction, −0.06, has been applied.

The average direction and force of the wind and the average cloudiness for the whole day are given unless they have varied more than usual, in which case the extremes are given. The scale of wind force is 0 to 12, or Beaufort scale. Two directions of wind, or values of wind force, connected by a dash, indicate change from one to the other.

The rainfall for twenty-four hours is now given as measured at 1 p. m. Greenwich time on the respective dates.

The rain gauge, 8 inches in diameter, is 1 foot above ground. Thermometer, 9 feet above ground. Gro'nd is 43 feet, and the barometer 50 feet above sea level.

Date.	Pressure at sea level.	Temperature.		During twenty-four hours preceding 1 p. m., Greenwich time, or 2:30 a. m., Honolulu time, of the respective dates.									
				Temperature.		Means.		Wind.		Total rainfall.	Average cloudiness.	Sea-level pressures.	
		Dry bulb.	Wet bulb.	Maximum.	Minimum.	Dew-point.	Relative humidity.	Prevailing direction.	Force.			Maximum.	Minimum.
	*	†	†			‡	‡		§				
1	30.05	71	63	77	70	62.0	67	nne.	4-6	0.02	7	30.09	30.02
2	30.01	71	64.5	77	70	59.5	64	ne.	3	0.09	10	30.08	30.02
3	29.91	64	63	79	69	63.3	71	nne.	2-0	0.00	4	30.03	29.89
4	29.92	60	59	79	63	64.0	78	w-n.	2-0	0.00	2-7-0	29.95	29.88
5	30.00	71	65	78	59	61.3	73	ne.	0-3	0.00	9	30.03	29.93
6	29.98	69	65	77	68	62.3	72	nne.	4-6	0.95	8-10	30.08	29.95
7	29.95	69	63	69	67	63.3	85	nne.	4-0	1.08	10	30.04	29.94
8	29.90	65	63	75	65	61.3	71	ne.	3-0	0.03	6	30.00	29.87
9	29.96	65	64	79	64	63.7	78	ne.	2	0.13	6	29.99	29.91
10	29.99	65	64	80	65	64.0	81	se.	2	0.00	5	30.04	29.95
11	29.98	67	66	81	64	66.5	84	se.	2	0.03	4	30.03	29.95
12	29.96	68	67.5	81	66	66.5	81	s.	0-2	1.68	8-10	30.00	29.91
13	29.98	70	69	79	68	68.3	88	s-w.	1	0.16	10-7	30.03	29.94
14	30.04	72	68	78	69	68.3	84	se-ne.	0-3	0.06	10-4	30.09	30.00
15	30.06	69	64.5	80	70	65.7	74	ne.	0-3	0.00	10-4	30.10	30.01
16	30.07	62	61.5	78	69	64.0	73	ne.	3	0.00	6-3	30.11	30.01
17	30.03	69	64.5	80	62	62.3	75	ne.	3	0.00	4-8	30.09	29.99
18	30.00	66	64	79	69	63.5	74	e-se.	3-1	0.00	3-10	30.06	29.96
19	29.92	68	67	80	64	65.5	79	sw-w.	2	0.04	6	30.01	29.93
20	29.93	61	59	77	67	63.3	79	ne-s-w.	1	0.00	8-10	29.98	29.90
21	29.87	58	57.5	79	58	59.7	70	wnw.	1-3	0.00	5	29.94	29.84
22	29.84	60	56.5	80	58	57.3	74	wnw.	2-4	0.00	4-0	29.92	29.79
23	29.84	64	57	75	57	55.7	68	n.	2	0.00	6	29.90	29.81
24	29.86	61	59	77	61	54.3	62	n-se.	1	0.00	4-0	29.92	29.83
25	29.90	66	65	77	59	61.7	76	s.	1	0.04	7-0-6	29.96	29.84
26	29.98	65	63.5	80	62	65.3	75	s-sw.	1-0	0.00	5	30.02	29.93
27	30.02	68	66	81	64	64.3	73	e-ne.	2	0.00	3	30.06	29.98
28	30.06	73	66	82	67	66.5	76	ne.	3	0.00	3	30.12	30.02
29	30.05	72	65	79	72	64.0	66	ene.	5	0.02	3	30.13	30.04
30	30.05	72	65	80	71	61.7	65	ne.	3	0.01	4	30.11	30.04
31	30.05	73	63.5	80	69	62.0	62	ne.	3	0.00	2	30.12	30.06
Sums	......	......	......	......	......	......	......	......	......	4.94	......	......	......
Means	29.973	67.0	61.4	78.5	65.4	62.9	74.1	......	......	....	5.8	30.033	29.940
Departure	−0.005	......	......	+0.5	+0.5	+2.0	+2.8	......	......	+0.78	+1.9	−.005	−.005

Mean temperature for March, 1899 (6+2+9) ÷ 3 = 71.2°; normal is 70.7°. Mean pressure for March is 29.987; normal is 29.982.

* This pressure is as recorded at 1 p. m., Greenwich time. † These temperatures are observed at 6 a. m., local, or 4:30 p. m., Greenwich time. ‡ These values are the means of (6+9+2+9) ÷ 4. § Beaufort scale.

METEOROLOGY OF THE YUKON.

Mr. U. G. Myers, Observer, Weather Bureau, who has been spending a year in Alaska on a furlough, sends a copy of a meteorological record made by him at Dawson City (N. 65° 5′, W. 139° 30′; elevation about 1,100 feet above sea level), during November and December, 1898, and January, 1899. Mr. Myers made a daily reading of the barometer and maximum and minimum thermometers, and noted the character of the day. Dawson is about 75 miles southeast of the Weather Bureau station at Eagle (N. 64° 45′, W. 141° 8′).

The following is a summary of his observations:

Month.	Temperature.							Total snowfall.	Depth of snow on ground.		Number of days—			Prevailing direction of wind.
	Maximum.	Date.	Minimum.	Date.	Mean maximum.	Mean minimum.	Mean (max. and min.).		On 15th.	At end of month.	Clear.	P. cloudy.	Cloudy.	
1898.	°		°		°	°	°	*Ins.*	*Ins*	*Ins.*				
November *	23.3	13	−41.4	19	−10.9	−17.8	−14.4	.....	9.0	12.0	10	8	12	n.
December	38.0	6	−41.0	31	3.5	− 7.9	− 2.2	10.0	18.0	22.0	16	12	3	n.
1899.														
January	2.0	21	−45.0	25	−15.7	−27.2	−21.4	6.0	24.0	28.0	11	4	16	n.

* For 29 days.

November, 1898: Yukon closed at 9 p. m. on the 3d. Snowfall on the 10th, 24th, and 26th.

December, 1898: Light rain for a few minutes during afternoon of the 6th. Light snow fell on the 1st, 2d, 3d, 14th; heavy snow on the 15th, 22d, and 24th.

January, 1899: Light snow on 9th; heavy snow on 28th.

SNOW ROLLERS.

By A. H. THIESSEN, Observer Weather Bureau.

As a slight contribution to the literature of natural snowballs the following will be of interest.

Mr. Walker, a voluntary observer at Dearborn Canyon, Mont., sent in the following remark with his January report:

On the 27th at 9 a. m. a high west wind began blowing that caused the moist snow to roll along the ground and form large snowballs, until the fields and pastures looked as if Mother Nature had been amusing herself on a large scale.

Mr. Walker has since been in the Helena office and a more detailed description has been secured. The scene of this phenomenon was a rolling field. Six inches of very light snow fell the day before. At the time of the phenomenon the observer judged that the temperature was about at the freezing point. The wind was blowing a gale, estimated at 40 miles per hour. The snow was lifted up in sheets before it began to roll, just as one would roll a sheet of paper. The balls were of all sizes, and were formed on the upgrade as well as on the down. They were even forced over a small knoll and were then assisted by a gravity into a hollow where many were collected. No very reliable data could be obtained as to structure. The small balls were spherical and the larger ones were cylindrical. There was also a hole through the center three to six inches in diameter. Later in the day a chinook reached the station dissipating the snow and leaving these monuments for awhile showing what rare and singular conditions may occur in nature.

RECENT PAPERS BEARING ON METEOROLOGY.

W. F. R. PHILLIPS, in charge of Library, etc.

The subjoined list of titles has been selected from the contents of the periodicals and serials recently received in the library of the Weather Bureau. The titles selected are of papers or other communications bearing on meteorology or cognate branches of science. This is not a complete index

of the meteorological contents of all the journals from which it has been compiled; it shows only the articles that appear to the compiler likely to be of particular interest in connection with the work of the Weather Bureau:

Ciel et Terre, Bruxelles, 20me année.
St. Hepites. Climatologie du littoral roumain de la mer Noire. [Concluded.] P. 49.
Comptes Rendus, Paris, Tome 128.
Gautier, A. L'iode existe-t-il dans l'air? P. 643.
" Quantité maximum de chlorures contenus dans l'air de la mer. P. 715.
Das Wetter, Berlin, 16 Jahrg.
Plumandon. J. R. Der Regen. [Concluded.] P. 65.
Barthe, O. Synodischer Mondumlauf und Temperatur. P. 61.
Journal of the Franklin Institute. Philadelphia. Vol. 147.
Haupt, H. The Problem of the Mississippi. P. 297.
Meteorologische Zeitschrift, Wien, Band 16.
Hergesell, H. Ergebnisse der internationalen Ballonfahrten. P. 49.
Kohlbrugge, J. H. F. Meteorologische Beobachtungen zu Tosari. (Java.) [Concluded.] P. 63.
Streit, A. Wolkenstudien bei dem Hagelgewitter am 1 Juni 1898 über Wien. P. 76.
Hann, J. Zum Klima der Anden von Argentinien. P. 83.
Nature, London, Vol. 59.
Milne, J. Seismological Observatory and its Objects. Pp. 487 and 579.
Callendar, H. L. Measuring Extreme Temperatures. P. 494.
Naturwissenschaftliche Rundschau. Braunschweig. 14 Jahrg.
Schwalbe, G. Ueber die jährliche Variation der erdmagnetischen Kraft. P. 145.
Philosophical Magazine. London. Vol. 47.
Rayleigh, *Lord.* Transmission of Light through an Atmosphere Containing Small Particles in Suspension, and the Origin of the Blue of the Sky. P. 375.
Wood, R. W. Some Experiments on Artificial Mirages and Tornadoes. P. 349.
Scientific American. New York. Vol. 80.
———Some New Kite Experiments at Bayonne. [Made by W. A. Eddy.] P. 213.
Morton, H. Liquid Air as a New Source of Power—Another Engineering Fallacy. P. 245.
Scientific American Supplement.
Meyers, C. E. Dirigible Air Vessels. P. 19,457.
———The Mont Blanc Meteorological Observatory. P. 19,469.
Southern Farm Magazine. Baltimore. Vol. 7.
McAdie, A. G. Frosts and Freezes. Results of Experiments on Protection of Citrus Fruit at the Bradish-Johnson Estate, Woodland, La. P. 12.
Symons Meteorological Journal. London. Vol. 34.
Symons, G. J. Extremes of Temperature in London and its Neighborhood for 104 years.
Terrestrial Magnetism. Cincinnati. Vol. 4.
Elster, J. und Geitel H. Beobachtungen über die Eigenelectricität der atmosphärischen Niederschläge. P. 15.
Bauer, L. A. Physical Decomposition of the Earth's Permanent Magnetic Field. No. 1. The Assumed Normal Magnetization and the Characteristics of the Resulting Residual Field. P. 33.

UTILIZATION OF FOG.

By A. McL. HAWKS, Civil Engineer, Tacoma, Wash.

Before attempting to discuss this in a general way, let us look at it in some specific case. I spent March to May of 1898 in San Diego. The country was absolutely arid; no rain of import had fallen in eighteen months, the streams were dry, the huge reservoirs almost empty, ranches were barren, wheat fields burnt up, cattle driven out of the State, fruit trees dying for lack of water. And yet almost every evening (I think safely three out of five) tons upon tons of water rolled in from the ocean over the land; hung there all night long, only to evaporate in the a. m., with the parched land *almost* as thirsty as before its visit. Perhaps in that "almost" we will find the clue to the solution of the problem.

The diurnal cycle usually reads thus: At about 10 a. m. a sea breeze springs up, blowing 12 to 20 miles per hour from the west, with the sun shining as it only can shine in the arid countries; at 5 p. m. the breeze falls until by 6 p. m. it is usually gone so entirely that the sailors' method of licking a finger to detect the direction of the wind fails to find any stirring. As the breeze dies down a bank of fog forms out over the ocean and rolls shoreward. This is usually about 500 feet deep, and when it strikes Point Loma dashes up into the air like spray from a rock. Long after the wind dies out the fog continues to roll inland until it finally reaches the hills at 1,000 to 1,500 feet elevation and 25 to 40 miles inland. Rarely in the *early* evening does it climb to the summits of these hills (2,000 to 3,000 feet elevation), though usually it rolls over them before morning.

By 8 p. m. the grass is quite wet (as if a shower of, say, ten minutes duration had passed over), the bushes commence to become damp, and various other objects compel condensation in various degrees. Shiny black painted iron is one of the best gatherers of moisture which I noticed; objects of the same kind varied according to their position. For instance, the house in which I lived was painted while I was there and immediately became a *great* moisture gatherer; the front steps had become "cupped" through the warping influence of the sun *before* they were dry; after painting they held a pool of water each morning. The banisters or hand rail (at an angle of, say, 30°) collected about as well as the steps, but the uprights scarcely at all. A foot inside the rail of the piazza no precipitation occurred. One's hair would collect considerable moisture, *especially* curly hair. Glass, *upright*, almost no effect; at an angle of 45°, *on both sides* of the glass. The bare earth almost no effect, and yet in little depressions often the surface would be quite damp and darkened by moisture. Does not this fog condensation follow similar lines to those observed and reported in the Journal of the Franklin Institute, about 1876.

All night long this fog bank lies over the land. Soon after sunrise, generally about 8 a. m., the breeze springs up from the west and by 10 a. m. the conditions are exactly the same as on the preceding day.

You have suggested in your comments (I think it was the MONTHLY WEATHER REVIEW for October, 1898, p. 466) that some mechanical means might be employed to condense or collect the moisture. It appears to me that would be too expensive and hardly practicable. Will not the same conditions obtain under the tree as under the piazza roof? In fact they do obtain to a great extent, as the soil near the base of a sizable citrus tree is never wet by the fog. If you could persuade the citrus to grow with its leaves all aslant downward, so as to collect and drip, something might be done. I do not believe any sort of upright surface would aid in collecting moisture.

With all the conditions as they are on these foggy nights, might not something of value be expected if liquified air were liberated? Engineering News figures out from Trippler's data that one gallon of liquified air could be manufactured (in considerable quantities, of course) for 15 cents; its chief difficulty at present is transportation; given the assurance of commercial success and every city with an ice plant will change the latter into a liquid air plant.

There may be two ways of utilizing this liquid: First, in a similar manner to the protection of gardens against frost by making a smudge and allowing the smoke to cover the ground. With everything so favorable that a slight condensation is already taking place, will not the additional cold liquid carry this work on more rapidly? The evaporation will take up the heat, but if simply allowed to evaporate it seems to me the cold area (from the expansion of the liquid air) will gradually spread. One gallon of liquid air equals about 100 cubic feet of atmosphere. If 100 gallons were expanded (at a cost of $15) is it not reasonable to suppose it might cover an orchard of 5 acres? The second method is dependant upon an entirely different course; the facts are not ascertainable absolutely but are reasonably true. If there is a lower stratum

of warm air superposed by strata of cold air (which I surmise is the prevailing condition on foggy nights) the whole atmosphere is in a state of unstable equilibrium; if you can construct a stack leading from the cooler air down through the warm air to the earth's surface, will not the cool air descend and spread over the surface, gradually lifting the warmer air it displaces, and will not that produce rain?

[See the Editor's notes on page 113.]

NOTES BY THE EDITOR.

WILLIAM H. HAMMON.

It is so rare that an official of high standing in the Weather Bureau resigns his position, that we are persuaded that the recent resignation of Prof. W. H. Hammon must have been the result of overpowering inducements and persuasive offers from other parties. We certainly hope that coming years will bring to him the profit and the pleasure that he evidently anticipates. By his acceptance of a position in the Philadelphia Gas Company at Pittsburg, Pa., Professor Hammon is brought back to his old family home and enters upon a business career of great promise, but the Weather Bureau loses one of its ablest men.

Mr. Hammon was born in Dicksonburg, Pa., and is a graduate of Allegheny University, and a post graduate of Cornell University. He entered the meteorological work of the Signal Service in July, 1882, and went for instruction to Fort Myer, Va. His first official assignment was as assistant at Charleston, S. C. In May, 1884, he was assigned to duty in connection with the physical laboratory of the Signal Office, where he assisted Prof. Thomas Russell and his successor, Prof. T. C. Mendenhall. Becoming interested in the exploration of the upper air, he volunteered to perform the meteorological work to be carried out in a series of balloon voyages during the first few months of 1885. This work, and the investigation of the apparatus incident thereto, was executed in an excellent manner, and his report, which could not be published at that time, afterward appeared in the American Meteorological Journal for February, 1891, Vol. VII, p. 498–528.

Mr. Hammon was subsequently in charge of stations at Ithaca, Cleveland, and St. Louis, and in May, 1894, was placed in charge of the San Francisco station and forecast district, the latter embracing the States of California, Nevada, Arizona, and Utah. By his administration of this latter charge, during the past five years, he has made for himself an enviable reputation for energy and efficiency. His forecasts of frosts and rains have been universally recognized as extremely reliable and timely. His latest bulletin "Frost: When to expect it and how to lessen the injury therefrom," shows that he has devoted much thought to this subject, and, in response to urgent demands, a large edition of it has been printed.

Mr. Hammon was appointed local forecast official in July, 1891; forecast official in August, 1894; professor of meteorology in January, 1899; his resignation takes effect March 31, 1899.

THE PACIFIC COAST DIVISION OF THE CANADIAN METEOROLOGICAL SERVICE.

It is probably known to only a few of our readers that in the summer of 1898 the Canadian service established a Pacific coast division, with headquarters at Victoria, B. C., where forecasts will be made by Mr. F. Napier Denison.

Mr. Denison expects to issue daily maps and forecasts for his division similar to those issued by the United States Weather Bureau officials at San Francisco and Portland, Oreg. A complete interchange of daily telegraphic reports takes place between these two branches of our respective national weather services, so that the information available to one is also accessible to the other, the only difference being that reports coming in by mail are interchanged more slowly than those by telegraph. Through the kindness of Mr. Denison, the Editor has received a copy of the daily map prepared by him and the northwestern quarter of this map is reproduced on Chart X. The original base map extends from the Pacific coast eastward to the eighty-fifth meridian, and from latitude 30° N. to 70° N. This places the boundary between the United States and the Dominion of Canada nearly in the center of the sheet, 16 inches broad by 17 inches high. The polyconic projection is adopted, the scale being practically the same as that of the daily map published by the Weather Bureau in Washington and by the meteorological office in Toronto, respectively. In our present reproduction we have added, in dotted lines, the approximate courses of a few lines of telegraph, so that the reader may appreciate how rapidly this country is being opened up, and what are the immediate possibilities of a still further extension of the daily telegraphic weather map. As the upper left-hand corner of Mr. Denison's daily weather map embraces the lower portion of the Territory of Alaska, we have added the new Weather Bureau station at Eagle, and the post route at present adopted for United States mails. The following extract from Mr. Denison's letter will excite the most lively interest in the minds of those who realize how far the forecasts of weather in the United States depend upon by a knowledge of what is transpiring in that distant region.

> This is certainly an ideal field for studying the various weather changes, which, as you know, are more difficult to anticipate here than further east, however, I am getting a grand insight into some of the complex problems, and I hope during this summer by studying last winter's charts, to be able to do some really valuable forecasting. As it is the public appreciates our work, and thinks we are doing very well. We are now using a new chart, specially designed for future expansion northward, even including Dawson, which most certainly will be made one of our telegraphic stations as soon as the projected wire communication is completed. I send you under separate cover a copy of one filled in, showing how after receiving Port Simpson by mail we are even now able to draw our isobars far further north than heretofore, and locate more accurately the true position of the north Pacific "highs" and "lows."

MIROBIA AND SEICHES.

In the MONTHLY WEATHER REVIEW for December, 1898, page 563, we have quoted a paper by Mr. F. Napier Denison, in which he states that the term *mirobia* was first introduced to English readers by Admiral Smythe as a word used at Malta as the name of regular recuring waves similar to the seiches of the lakes in Switzerland. Mr. Denison has been studying the same phenomena on the Great Lakes, and for fear least the Editor may have misunderstood Mr. Denison's position in this matter, the latter writes as follows:

> You seem to think I have taken up the study of water undulations on both lakes and ocean as of more value in a meteorological point of view than the study of the atmospheric waves shown on the various barographs, which latter waves I have tried to prove set up the water undulations. Now this was never intended. I have been endeavoring simply to draw attention to the fact that as the water surface responds to the passage of atmospheric waves over it, therefore the records from tide gauges would often show marked undulations at stations where no barographs are; or even should the latter be also there, only the largest undulations will be seen, as the present instrument in common use gives a weekly curve which means too small a time scale and baro-

metric scale to show the smaller undulations. These are really the most important ones, as they often occur during fine weather when the storm may be hundreds of miles distant. Then again I have found ordinary observers allow too much friction between the pen and paper, and often do not keep the pen point as fine as it should be. For this and many other reasons I have made a strong plea for the universal introduction of extra sensitive barographs with open scale, and teach those in charge the true value of these minute undulations. I find these secondary tidal undulations beautifully recorded upon the Esquimalt gauge sheets, and now that my large hydro-aerograph has arrived I hope to make a minute study of this phenomenon in the Victoria Harbor.

METEOROLOGICAL REPORTS BY CABLE FROM ICELAND.

In 1880 Hoffmeyer gave utterance to the oft expressed conviction of many meteorologists that daily telegraphic reports from Iceland would be of inestimable value in weather predictions for Great Britain and northern Europe. This subject has been favorably reported upon several times by the International Meteorological Committees and Congresses (Berne, 1880; Copenhagen, 1882; Munich, 1891; etc.) The commercial intercourse with Iceland would, however, evidently not pay the interest on the cost of the cable, and it is only quite lately that the Danish meteorologists have received from business men a proposition that makes the project seem at all feasible.

The "Grande Compagnie des Télégraphes du Nord," having its center at Copenhagen, calculates that the expense of the installation of the cable from Shetland, touching the Faroe Islands and ending at Iceland, together with the land lines will be $600,000, and that an annual payment of $36,000 for twenty-eight years would liquidate this debt. The maintenance of the cable and stations adds $32,000, so that an annual revenue of $68,000 must be provided for.

The above-mentioned telegraph company will undertake to build and to maintain the line if it is guaranteed this annual revenue for the first twenty years only. The Government of Denmark and Iceland will establish and maintain the meteorological stations and the expense of daily telegraphic bulletins, and will perform the hydrographic work necessary in connection with the laying of the cable, and will also guarantee an annual subvention of $25,000 for twenty years. Therefore, all that now remains to be done in order to secure telegraphic communication with Iceland for commercial and meteorological purposes is to secure the remaining annual income of $41,000. It is hoped and believed that a large portion and perhaps all of this may be secured by national legislation in the States of Europe and America that are interested in this subject. The sums required from each of these would scarcely amount to the salary of one or two employees, and would be abundantly counterbalanced by the increase in our knowledge of the atmosphere and our ability to make predictions of storms and cold waves.

There is, in fact, no reason why the larger newspapers of the world should not also add their contributions as the news items will, of course, have a commercial value.

At present American meteorological services seem to be deeply interested in extending their own systems north, west, and south, rather than eastward.

THE INTERNATIONAL METEOROLOGICAL COMMITTEE.

The next meeting of the International Meteorological Committee has been called for the 25th of August, 1899, at St. Petersburg. The following are the members of the committee as selected by the International Conference, Paris, September, 1896. (See MONTHLY WEATHER REVIEW, October, 1896, p. 367):

E. Mascart, France, *President*.
Robert H. Scott, Great Britain, *Secretary*.
W. V. Bezold, Germany.
R. Billwiller, Switzerland.
J. de Brito-Capello, Portugal.
Walter R. Davis, Argentine Republic.
John Eliot, India.
Julius Hann, Austria.
Stefano Hépites, Roumania.
H. H. Hildebrandsson, Sweden.
H. Mohn, Norway.
Willis L. Moore, United States.
Adam Paulsen, Denmark.
H. C. Russell, New South Wales.
M. Rykatcheff, Russia.
M. Snellen, Russia.
P. Tacchini, Italy.

Vacancies occasioned by death or resignation may be filled by the committee. The committee may also invite others to take part in its discussions.

Besides this general International Committee there were several special committees appointed by the International Conference, such as the subcommittee on international telegraph service; the subcommittee on terrestrial magnetism and atmospheric electricity, whose last meeting was held at Bristol, England, August, 1898; the subcommittee on instruments and methods of observation; the subcommittee on clouds, under whose initiative a special work on this subject was conducted during the year July, 1897-98; the subcommittee on aeronautics, whose meeting at Strasburg in 1898 was reported upon by Mr. A. L. Rotch in the MONTHLY WEATHER REVIEW for April. 1898, p. 158.

The reports of these subcommittees and the questions thus far proposed for discussion by individual meteorologists are embodied in the following provisional program of the meeting to be held at St. Petersburg. This meeting of the General Committee will, also, undoubtedly, designate the time and place of the next general conference.

1. Report of M. Rücker on terrestrial magnetism and atmospheric electricity.
2. Report of M. Hildebrandsson on clouds.
3. Report of M. Hergesell on balloon ascensions.
4. Report of M. Violle on radiation and insolation.
5. Rykatcheff.—Is it desirable that the committee should occupy itself with observations of earthquakes?
6. von Bezold.—Antarctic explorations.
7. Hildebrandsson.—The centers of action of the atmosphere.
8. Rykatcheff.—Definition of the meteorological day.
9. Rykatcheff.—Instructions for the use of sunshine recorders.
10. Rykatcheff.—Rules for the determination of soil temperatures.
11. Rykatcheff.—Precautions to be taken in using alcohol thermometers.
12. Rykatcheff.—Symbol to be employed for designating low fog.
13. Rykatcheff.—Define the meaning of the symbols employed to designate storms.
14. von Bezold.—Protection of magnetic observatories against industrial electrical works.
15. Hann.—Proposition for the publication in a special form of the tables of the diurnal range of temperature in each country.
16. Hann.—Importance of actinometric observations.
17. Teisserenc de Bort.—Installation of anemometers.
18. Teisserenc de Bort.—Employment of carrier pigeons by the transatlantic steamers for conveying information as to the weather west of Europe.
19. Date of the next International Conference.

METEOROLOGY IN RUSSIA.

On the 13th of April, 1899 (April 2, according to the old style calendar as used in Russia), the Central Physical Observatory in St. Petersburg celebrates the fiftieth anniversary of its foundation. This will be made a notable festival occasion. The Czar and many of the highest dignitaries in diplo-

matic and scientific circles will probably be present; congratulations will be received and honors conferred, and nothing that can add to the brilliancy of the celebration will be neglected.

It is a pleasure to call attention to this renewed evidence of the high position occupied by meteorology in the Russian Empire.

Fifty years ago our branch of science was known as the youngest of all. In those days Humboldt, Dove, Sabine, Glaisher, Quetelet, Leverrier, Kämtz, Kupffer, Espy, Redfield, Reid and Piddington, Loomis and Henry had only lately begun the long series of studies that have culminated in the modern weather bureau and the daily weather map. The science that was born with Galileo, and was fostered by Newton, d'Alembert, Euler, and Laplace, attracted much attention by the middle of the nineteenth century and soon demonstrated its value to mankind and the necessity of its further development. Two centuries had been spent in accumulating meteorological and climatological data before we began to understand some of the mechanical principles that the atmosphere must obey. Now, every year adds to our knowledge of the physics of the atmosphere. While government weather bureaus everywhere cultivate climatology, properly so-called, they are also studying the physical and mechanical problems relative to the motions of the atmosphere, or dynamic meteorology. By common consent the problems of terrestrial magnetism are also at present included in the work of many government weather bureaus, as having a possible but very problematic bearing on atmospheric phenomena. This wide range of studies has been brilliantly cultivated by the labors of the officials of the Central Physical Observatory of Russia. The history of this institution is the history of meteorology in Russia and it is proper to recall some of the phases of this history and some of the prominent scientists.

In 1702–3 Peter the Great wrested the lands about the river Neva from the hands of the Swedes and Finns and on May 16, O. S. (May 27, N. S.), began the erection of the fortress about which St. Petersburg has grown. On January 11/22, 1718, Peter the Great issued a decree ordering that an academy of science should be established and the details of this organization were further elaborated in a decree of January 20/31, 1724, published about a year before his death on January 28 / February 8, 1725. The academy is still located in the building then erected for it on Vasili-Ostroff; it originally consisted of ten members, which number is now considerably increased; its object is to provide for the advancement of science, for public scientific lectures and meetings, for scientific instruction in the universities and for the proper conduct of various branches of scientific work fostered by the government as being essential to the public welfare. The original ten members were largely chosen from prominent scientific men in the other States of Europe, especially France, Germany, and Switzerland. One of them, Captain Behring, belonging to the Baltic Province of Jutland, was appointed a member while he was still away on his great voyage of exploration to Behring Sea, during the years 1725–1728. The plans of Peter the Great were further advanced by the Empress Catherine I. Among the earliest academicians were Nicholas and Daniel Bernoulli of Bern and Berlin, Herman of Basle, Goldbach of Königsberg, Delisle of Paris, Leonard Euler of Berlin. The first public session was held December 27 (N. S., January 7, 1726).

The organization of European academies of science differs generally from that of similar organizations in America, in that the academicans are appointed by high government authority. They are responsible for carrying out the scientific work of the government. They are not merely students and advisers, but directors of large enterprises. They are expected to exert a powerful influence upon the general development of science in the nation.

In addition to the St. Petersburg Academy, which dates from 1725, we must recognize several other institutions in Russia that have done good work for meteorology. First of all we must mention the Russian Navy, or the so-called Admiralty Office, which has been distinguished since the days of Behring, who entered it in 1704, until the present time, when Rykatcheff represents the highest development of meteorological science. We must mention the Free Economical Society of Russia, which was organized in 1765. This is independent of the Government. The word *free* is used in the same sense as in the case of the Free Church of Scotland. This society has devoted itself largely to the interests of agriculture, and has assisted in the study of climatology. The fourth organization to be mentioned is the Imperial Russian Geographical Society, which dates from 1845. At first climatology was considered as a minor and incidental matter in the transactions of this society, but of late years, under the influence of Woeikoff, Klossoffsky, and Tillo, it has done much to develop the study of thunderstorms, magnetism, and the whole range of terrestrial physics.

But most important of all in the highest interests of science has been the influence of the noble university at Dorpat. Some account of this university and its relations to Russian astronomy was prepared by the present Editor for publication in the Annual Report of the Smithsonian Institution for 1867. This university was founded by the Emperor Alexander I by a decree dated December 12/24, 1802, and permanently restored to Dorpat the prominence and importance that that place had held for twelve hundred years. To this university science is indebted for many most prominent names. To Prof. F. G. Parrot, the elder, astronomy owes a heavy debt, in that he first discovered the astronomical enthusiasm and ability of F. G. W. Struve and secured his appointment as professor of astronomy in 1813. Meteorology also owes an equal debt to Parrot, who was one of the most learned members of the University of Dorpat during the years 1802–26; his influence was felt in every branch of science as well as in the administrative affairs of the University. His son, F. R. Parrot, succeeded him as professor of physics during the years 1827–40, and he in turn was succeeded by Prof. L. Kämtz in 1841. In 1865 Kämtz was called to St. Petersburg, and was in turn succeeded by A. von Oettingen, who, in 1891, removed to Leipsic.

Karl Ernst von Baer was born on his paternal estate Piep in Esthonia on February 5/17, 1792. He became professor in the University at Königsberg, but in 1830 removed to St. Petersburg as a member of the Academy of Sciences. In 1866 he resigned the latter position and settled at Dorpat where he died November 16/28, 1876. Von Baer's principal works related to the geology, geography, and climate of Russia, including articles on the climates of Sitka, New Zealand, and Siberia.

Besides these, Dorpat has given to meteorology A. Wiszniefski, whose thesis for the degree of A. M. in physics in 1853, dwelt on the mean annual temperature of the earth's surface as a function of the latitude and longitude, with a chart of isotherms for the whole globe. Among other celebrated names are those of Lenz, Kämtz, and Kupffer all of whom, following in the footsteps of the elder Parrot, prepared the way for the establishment of the meteorological system of the present Central Observatory.

Emil Lenz was born February 24 (O. S. February 12), 1804, in Dorpat. At the University his interest in the physical sciences was excited through the influence of the elder Parrot, and by him he was recommended as meteorologist and physicist to the exploring voyage of Kotzebue, although he was at that time only nineteen years old. The expedition left Cronstadt in July, 1823, reaching Kamschatka in June, 1824, and Sitka in August, 1824. After visiting California

and the Sandwich Islands the expedition returned to Kronstadt, July 22 (O. S. July 10). During this voyage of three years Lenz maintain continuous studies and observations in meteorology and the physics of the ocean. After his return he lived at St. Petersburg. In 1828 he became an adjunct member of the Academy of Sciences, and in 1834 a full member. In 1829 he carried out an extensive expedition to the Caucasus in connection with Kupffer. In 1835 he became professor of physics and physical geography at the University of St. Petersburg. His text-books on these subjects were highly esteemed. His contributions to science are mostly to be found in the memoirs of the Academy. He died at Rome, February 10, 1865 (O. S. January 29), while traveling abroad for his health.

Adolph Kupffer was born at Mittau in 1798. After studying at Dorpat he went to Berlin, Göttingen, and Paris and was then called back to the University at Kasan, having already become known by his publications relative to crystalography. In 1828 he was called to St. Petersburg as a an associate of the Academy of Sciences, and in 1840 was appointed to the vacancy made by the death of Parrot. Up to this time Kupffer's work had been largely in connection with mineralogy, but he now began to apply his knowledge to the development of the whole subject of meteorology, magnetism, and the physics of the globe, and to the establishment of a department of standard weights and measures for the Russian Empire, so that he fully realized our ideal of a scientific investigator who understood the practical application of knowledge to the needs of the country. He organized a broad system of meteorological and magnetic stations for the investigation of the climate of Russia and the physical and geographical problems connected therewith. He was professor of physics in the Institute of Mining Engineers as well as in other educational establishments in St. Petersburg. Numerous journeys were necessary throughout Russia and southern Europe in connection with the establishment of his stations and their subsequent inspection. He also took an active part in the conference of 1863 in England for the establishment of an international system of weights and measures. He died in 1865, June 5 (O. S. May 23), at St. Petersburg.

One of the most active workers in meteorology and one who held a position that gave him much influence at St. Petersburg was, however, not from the Baltic Provinces but from the interior of Russia.

Constantine Vesseloffski (or Wesselovski if we adopt the German spelling) was born in the town of Novomoskvosk in the Province of Jekaterinoslaff in southern Russia, on May 8/20, 1819. He devoted his life to the interests of the Academy of Sciences, and was its permanent secretary from about 1853 to about 1890. His scientific works relate principally to the geography and climate of the Russian Empire. He finally summed up nearly all that was known on this subject in two great volumes, published in Russian, entitled O Klimate Rossia, St. Petersburg, 1857.

In recent years central and southern Russia have given to meteorology other eminent men, such as Rykatcheff, Köppen, Woeikoff, and Klossoffsky. Something has also been done for meteorology by the Imperial Society of Naturalists at Moscow.

Kupffer was the founder, first director and organizer of the meteorological system of Russia, which he at first conducted under the auspices of the Institute of Mining Engineers. The first volume entitled: Observations Météorologiques et Magnétiques, faites dans l'Empire de Russie, rédigées et publiées aux frais du Gouvernement, par A. T. Kupffer, Membre de l'Académie des Sciences de St. Pétersbourg. Tome I—was published at St. Petersburg in 1837. This volume appeared in two parts, and was intended to be a periodical publication; but before the third part could be printed, Kupffer states that it had attracted the attention of the Emperor, who ordered that it should thereafter appear as an annual volume under the title: Annuaire Magnétique et Météorologique du Corps des Ingénieurs des Mines de Russie, etc. The first volume of the Annuaire was for 1837 and was published in 1839. Under this title successive annual volumes appeared up to that for 1846, which was published in 1849. In the meantime, the Emperor had established The Central Physical Observatory at St. Petersburg, as a common center of all that is done in Russia for terrestrial magnetism and meteorology, offering moreover everything necessary for making researches in every branch of physics. Kupffer states that this imposed upon him the necessity of enlarging the Annuaire, which thereafter appeared under the title Annales de l'Observatoire Physique Centrale. Beginning with the volume for 1847, which appeared in 1850, the Annales were published by Kupffer up to the time of his death, June, 1865. Thereupon, Professor Kämtz was called from Dorpat, but only one volume was published by him before he also died; the volume for 1864, although bearing Kupffer's name, was edited by Kämtz and published in 1866. Three years elapsed before the volume for 1865 was published in 1869, and it bears, as the author's name, H. Wild, the newly appointed member of the academy and director of the observatory.

Ludwig F. Kämtz was born January 11, 1801, at Treptow, Pomerania. In 1819 he entered the University of Halle where he studied mathematics under Pfaff, and especially devoted himself to mathematical and experimental physics. In 1827 he was appointed professor at this university. The physics of the atmosphere especially interested him, and as a summary of his many lectures on the subject he published, in 1827, 1832, 1836, the three volumes of his classical Lehrbuch der Meteorologie, which for many years held the highest rank, and will always be worthy of being consulted. In 1841 he was called to the University of Dorpat as professor of physics, where, among other things, he began the publication of his Repertorium für Meteorologie. He made many scientific journeys throughout Russia and especially the Alps. In 1865 he was chosen a member of the Academy at St. Petersburg and Director of the Central Physical Observatory, as the successor of Kupffer. Here he began a thorough reorganization of the climatological work and the meteorological stations, but his labors in this direction were unexpectedly brought to an end by his death after a short sickness at St. Petersburg, December 8/20, 1867. Lieutenant Rykatcheff, who began working with him in 1866, published at that time some interesting reminiscences in the journal of the Austrian Meteorological Society, April, 1868, illustrating the cheerful, happy, and kindly spirit of his illustrious master. The Editor had the privilege of a short acquaintance with Kämtz in 1865–66, and can also bear testimony to his great kindness toward the young students of science.

The successor of Kämtz, Heinrich Wild, was born at Zurich, December 17, 1833. He studied at the University of Königsberg where he took the degree of Ph D. about 1856 He was appointed lecturer and, in 1862, professor of physics at the University of Bern, where he also succeeded Rudolf Wolf as director of the observatory of the university. As it was difficult to do much astronomical work in the latter, Wild confined his attention to terrestrial physics, and was very active in connection with the reformation of the standards of measurement as well as every problem bearing on meteorological apparatus and methods. Under his successor, Dr. A. Forster, this observatory was rebuilt in 1876, and is now known as the Telluric Observatory of the University. In 1868, Wild was called from Bern to St. Petersburg as director of the Central Physical Observatory, leaving Bern in August of that year. His colleague, Prof. Aimé Forster, received and still retains his position at Bern. Wild's activity at St. Peters-

burg was as intense as in his early days at Bern. Finally, in July, 1895, he obtained permanent leave of absence on account of his health, and is now living quietly at Zurich, but still remains an honorary member of the Academy of Sciences at St. Petersburg.

Wild's first step was to request the appointment of a committee of the academicans to confer together as to the reorganization of the Central Physical Observatory. The report of this committee on November 14-26, 1868, expressed the need of the great improvements that he proceeded to inaugurate, such as the establishment of a new observatory for the purpose of investigation, at Pavlosk, the introduction of the metric system, the issuance of new instructions, and the publication of a separate system of memoirs entitled the Repertorium für Meteorologie.

The last volumes of the Annales, those for 1865–69, published in the years 1869–71, were edited by Wild, who states that, as far as practicable, the volumes conform to their predecessors.

With the volume for the year 1870 begins the series published by Wild under the title Annalen des Physikalischen Observatoriums. In the introduction to this volume Wild says:

> With the year 1870 meteorological observations in the Russian Empire enter upon a new stage, in that on the 1st of January they begin to be made and reduced according to the new instructions for meteorological stations that I have drawn up with the approbation of the Academy of Sciences.

These instructions were published in the first volume of the Repertorium für Meteorologie, St. Petersburg, 1870, with some supplementary matter in the second volume. The volumes of the Annalen continued regularly, and that for 1894, published by Wild in 1895, was followed immediately by that for 1895, published by his successor, Rykatcheff, in 1896.

During Wild's administration a great impetus was given to all meteorological and magnetic work by the high character of the assistants whom he drew to him. By establishing his publication entitled Repertorium, which may be looked upon as the successor of the Repertorium started by Kämtz at Dorpat, Wild gave his assistants an appropriate place for the publication of their work, and created a standard of excellence that has never been surpassed and scarcely attained in any part of the world. The Astronomical Observatory at Poulkova and the Physical Observatory at Pavlosk, about 3 miles distant toward the southeast, on the great road to Moscow, shine as intellectual beacon lights for the guidance of students.

The memoirs in Wild's Repertorium were published in the languages chosen by the respective authors. French and German, Russian, English and Latin were equally acceptable. The first volume fulfilled a pious duty to his predecessor, Kämtz, by publishing several unfinished memoirs by that distinguished scientist, each of them being completed and edited by Wild's assistants, Koeppen, Rykatcheff, and Pernet. Independent memoirs by Koeppen, Fritsche, Woeikoff, Kiefer, and Wild himself complete the volume. The high esteem in which Kämtz was held is expressed by all of those who had been his pupils and assistants. Their intercourse with this learned man could never be forgotten. Koeppen says he was lamented by all who had the interests of science at heart. Among the assistants the reader will notice the name of M. Rykatcheff, who at that time was a lieutenant in the Russian Navy; in 1866 he had been assigned to duty under Kämtz, his first work being the study of the new method devised by Kämtz for determining the dip of the magnetic needle. The first few pages of Rykatcheff's memoir on this subject contain the last scientific writing of Kämtz, describing the magnetic work done by him in the summer of 1867.

Rykatcheff continued to be attached to the Central Observatory until the end of Wild's administration having for many years been the chief of the division of maritime meteorology and storm warnings. His position in the navy was also raised steadily by promotion until his appointment, in 1895, to succeed Wild as Director of the Central Physical Observatory and member of the Imperial Academy of Sciences. He now has the rank of major-general.

The appointment of Rykatcheff as Director of the Observatory, July 20, 1895, also marks a general change in the spirit of the administration of affairs in Russia where the so-called Russian element is now predominant. During the past two centuries the Russian czars have frequently called foreigners to St. Petersburg to superintend the development of scientific and practical works, but at the present time the tendency is to rely upon the old Russian families. The Repertorium, maintained by the Imperial Academy of Sciences as a medium for the publication of matters bearing especially on the work of the Central Observatory, is now discontinued, and the memoirs appropriate to it will hereafter be published either in the quarto memoirs or the octavo bulletins of the physical section of the Academy of Sciences. The observations, properly so-called, consisting entirely of numerical tables, will continue to be published in a separate volume but under the former title of Annales de l'Observatoire Physique Centrale.

We should not close this sketch of Russian Meteorology without mentioning one who has done so much to make Russia well known to the rest of the world. Prof. Dr. Georg Adolph Erman was born in Berlin, May 12, 1806, and died in in that city July 12, 1877. He was the son of the equally distinguished Paul Erman. In 1828–1830 Adolph Erman joined the Norwegian expedition to Siberia, which he afterwards extended to a tour around the world. His scientific work on this occasion embraced every branch of science, but especially magnetism and meteorology and the results were published in seven volumes, generally known as Erman's Reise um die Welt. His intense activity on this occasion brought forth new ideas too numerous to mention and threw a flood of light upon our knowledge of meteorology and magnetism. He had received the degree of doctor of philosophy at the Berlin University in 1826 and was now made professor-extraordinary in 1839. The rest of his life was devoted principally to terrestrial physics, especially magnetism, meteorology, seismology, and meteors; but the greatest work that he undertook was his Archiv für Wissenschaftliche Kunde von Russland, which began in 1841 and has been carried on by others since 1856. In this periodical one may find translations and summaries of all the great works either by Russians or by others exploring in Russia, together with the results of his own work. Erman's general numerical comparison between the Gaussian Theory of terrestrial magnetism and the results of actual observations was one of his heaviest pieces of mathematical and numerical work. One of his last publications, however, is of special interest to meteorologists. It is entitled: Ueber den permanenten oder mittleren Zustand der Erdatmosphäre, and is published in the Astronomische Nachrichten for February, 1868. Herein he states that ever since his journey through Siberia he has demonstrated and maintained that the atmospheric pressure at sea level is not the same all over the globe, and he now proceeds to give the necessary formulæ in hydrodynamics explaining why this unequal distribution of pressure exists. His memoir on this subject takes special account of the resistance to the motion of the atmosphere by the surface of the earth and by the convection currents in the air. It, therefore, occupies a different field from the work published in 1859 by Ferrel, and may be considered as supplementary thereto; Ferrel considered the influence of density of the air as determining its motion, but

left the influence of friction to be found from observations. Erman deduces this latter influence analytically.

THE DAILY WEATHER MAP FOR MEXICO.

A great addition has lately been made to our knowledge of the meteorology of North America by the publication of the daily weather map for the Republic of Mexico, the issue of which began March 1, 1899. The map is about 12 inches high by 16 broad, and enables one to make immediate connection with the daily map of the United States and Canada. The observations are made simultaneously at 8 a. m., on the seventy-fifth meridian or 6:23 a. m., local mean time of the City of Mexico. Barometric pressures are reduced to sea level, but apparently not to standard gravity. The temperatures are surface observations and not reduced to sea level. The metric system is used. The observations are made by the officials of the federal telegraph system, whose director general, Senor Chaves, with the assistance of Senator Bárcena has finally succeeded in accomplishing this great work under the general direction of the Secretary of the Department of Roads and Public Works. A sample map is reproduced on Chart XI of the present REVIEW. The reader will easily convert the isobars and isotherms into English equivalents by the following small table:

Pressure.		Temperature.	
Millimeters.	Inches.	C.	F.
		°	°
740.0	29.13	−40	− 40
742.5	29.23	−35	− 31
745.0	29.33	−30	− 22
747.5	29.43	−25	− 13
750.0	29.53	−20	− 4
752.5	29.63	−15	+ 5
755.0	29.72	−10	+ 14
757.5	29.82	− 5	+ 23
760.0	29.92	0	+ 32
762.5	30.02	+ 5	+ 41
765.0	30.12	+10	+ 50
767.5	30.22	+15	+ 59
770.0	30.32	+20	+ 68
772.5	30.41	+25	+ 77
775.0	30.51	+30	+ 86
777.5	30.61	+35	+ 95
780.0	30.71	+40	+104
782.5	30.81		
785.0	30.90		

This map appears as an annex to the Boletin Telegrafico, published by the Department of Federal Telegraphs. The first number of the Boletin and map is dated March 1. The text of the Boletin seems to be confined to statistical data, relative to imports and exports, but we copy the following remarks from the first number.

THE UTILITY OF THE WEATHER MAP.

(Translated from the Boletin Telegrafico of March 1, 1899.)

The meteorological phenomena of any locality are not isolated and independent; they are not even complete phenomena but are parts of one that started far away, and which, in its subsequent development, assumed various aspects and traversed hundreds and thousands of kilometers. A single city or a limited region sees only one phase of the whole phenomenon.

Hence the necessity for comparing the meteorological records collected in various localities. In order to obtain such data, the Central Meteorological Observatory requested from the telegraph companies of the federal system, simultaneous observations of weather conditions.

These observations were, however, deficient and imperfect, and of very little use to the Observatory on account of the inaccuracy which such observations necessarily possess when based upon the appreciation of each individual and not upon the readings of appropriate instruments.

The Director of the Federal Telegraphs desirous, through his service, of assisting the Observatory with more accurate and incomparably more useful records, distributed among 35 telegraph offices the instruments necessary for obtaining the data relative to pressure, temperature, humidity of the air, direction and force of the wind, taking care that these 35 offices should be at appropriate distances one from the other and properly distributed throughout the vast territory of the Republic. We should also state that in addition to the 35 federal stations four other private stations have also given us their cooperation; their assistance is much appreciated and gratefully acknowledged by the Director and their work will receive the publicity it merits.

The weather map, which is published in the Republic for the first time to-day, shows the weather conditions *at the same moment over the whole country*.

For the past six months, the observations, as recorded by the instruments, have been transmitted every day by telegraph, and the Central Office reduces and computes them by means of numerical tables properly prepared, in order to trace the curves of full and dotted lines, which show on the map the points all over the country where the pressures and temperatures respectively are the same. The pressures are drawn for every 2½ millimeters, and the temperatures for every 5 degrees. Of course, the regions between two isobars and two consecutive isotherms are comprised between the numbers represented by the said lines.

These lines are continuations of those of the United States and can be followed on the maps of that country. It was in order to form as it were one service that the Government of Mexico organized its own service on the same system as that adopted in the United States, and both countries make a daily exchange of their respective observations.

As regards the public, the principal object of a meteorological service like the one inaugurated to-day, is the prediction of the weather; such predictions are not possible except with a very long series of observations, and by taking all the precautions which the complexity of the atmospheric phenomena demand. These phenomena are the more complex in proportion as the region where they are observed is exceptional, as is the case in our country.

The record above referred to will aid the telegraph service in making more accurate predictions than it has yet ventured on, if only for the purpose of warning the inspectors of the damage likely to be done along the line of danger, and by causing the officials charged with the care of the lines, to take the necessary precautions in time, in order to foresee or to repair the damage often done by thunderstorms, particularly along the coast. Such precautions were adopted with good results on the occasion of the last thunderstorm.

Besides this, the telegraph service also derives from the simultaneous meteorological service, extending over large sections of country, the great advantage of acquiring a better knowledge of the conductibility and insulation of the telegraph wires. All of these direct benefits to the telegraph service contribute indirectly to the public good by conducing to a better telegraphic service than exists at present. In addition to this, there is also a great and direct advantage to be derived by the agriculturist, navigator, or who would undertake to collect, study, and analyze the maps and make his own predictions. Be this, however, as it may, the essential feature is in the official meteorological service itself, which affords the basis for the prediction of the weather. Such predictions will also be attained in the course of time.

JOHN H. HARMON.

Announcement is made of the death at Washington, D. C., on March 29, 1899, of Mr. John H. Harmon, of the Central

Office. Mr. Harmon was born in Detroit, Mich., in 1860, received his education in the common schools, and at the Michigan Agricultural College, and had taken a two years' course in the law school of the Columbian University at Washington.

He enlisted in the Signal Corps in September, 1879, and with the exception of about a year served continuously in that corps and after 1891 in the Weather Bureau until his death. He was stationed at Louisville, Minneapolis, Columbia, S. C., and at the Central Office. Mr. Harmon was a man of most kindly and genial disposition and a faithful and efficient observer and clerk.—*H. E. Williams.*

OBSCURE POINTS IN METEOROLOGY.

In a recent publication by the director of the Hongkong Observatory on The Law of Storms in the Eastern Seas there occur paragraphs that have caused some misapprehension and may need a word of comment in order to set the matter right in the minds of our readers. The following extracts are reprinted as preliminary to our comments. Speaking of typhoons in the eastern seas, Dr. Doberck, on page 3, says:

When the trough [A] of low pressure stretches from the south of Hainan through the Bashee Channel right out into the Pacific to the south of Japan and the northeast and southwest winds on either side of it are fresh or strong, the conditions have often been mistaken for two typhoons, one in the China Sea and one to the south of Japan, before ever any typhoon was formed.

The heavy rain is, of course, not the cause of the phenomena, for the rain itself is caused by the air rising in the axis of these depressions, also the water vapor condensing gives out heat, and thus, in the first instance, makes the mercury rise in the barometer before a squall; but there can not be any doubt that the quantity of water vapor condensed to form perhaps 10 inches of rain per day, and whose pressure is thus abstracted from the barometric pressure of the air, causes [B] the permanency of the depressions. It is different with the rainfall in the southwest monsoon. That is spread over a large area and does not give rise to a low pressure in one spot surrounded by higher pressures.

On page 7 he says:

When the wind rises in a typhoon it blows in gusts and the mercury heaves in the barometer. When the wind has reached force 11 it blows in fierce squalls of something about ten minutes' duration, while the mercury heaves up and down as much as a tenth of an inch. The mercury often gives a jump upward as the wind begins to veer in a squall. Then it drops down and gives another upward jump as the wind comes back to nearly its old direction. During these squalls an enormous quantity of rain falls in a few minutes. The temperature falls and rises a fraction of a degree or more. The wind does not return to quite the former direction, except just in front of the center. At the time when the center is nearest, a fierce squall is usually felt, and in that squall the direction of the wind changes considerably and the barometer begins to rise. The squalls appear to be caused by an up [C] and down movement of the air. As the air comes rushing down, the raindrops evaporate in the hotter stratum near the earth's surface, and, owing to the increased tension of water vapor, the barometer (after a fall caused by the cold of evaporation) begins to rise. The wind veers [D] toward the direction of the wind above, which latter is known from the motion of the clouds. Then the air starts to rise with a deluge of rain, caused by the condensation of vapor arriving at the cooler stratum above, while the barometer (after a rise caused [E] by the heat of condensation) drops down, owing to the cessation of the pressure of water vapor condensed into the rain fallen, and the wind resumes the direction determined by the central depression, for the latter is so great in a typhoon and gradients so steep near the center that subsidiary depressions have never occurred in the China Sea.

On page 11 Doberck says:

The wind blows from a region where the air pressure is higher toward one where it is lower. It is, however, deflected toward the right in the northern hemisphere. The force of the wind depends upon the difference of pressure between one place and another situated in the direction where the barometric slope or gradient is greatest. The gradient is measured in hundredths of an inch per 15 nautical miles. The force of the wind corresponding to a certain gradient is greater the hotter the air is, and is different in a typhoon from what it is in the trade, owing to the path of the air particles being curved. * * * [F]

The steepest gradient (1 inch in 15 miles) ever met with occurred in a low latitude in the Pacific. That corresponds to a wind velocity of perhaps about 160 miles per hour at sea level. Such velocities are not uncommon at an altitude of 2,000 feet in severe typhoons. [G] Anything above 80 miles per hour is called a typhoon. It is seen that there is as great a difference between the force of one typhoon and another as between a calm and a storm which nearly reaches typhoon force.

When a typhoon is blowing it is of great importance to have a house well shut up. Windows and doors should be firmly locked, bolted and barred. Damage is frequently caused by shutters being out of repair. Once the wind enters a broken window, it begins to blow through and its force is then quickly felt. As long as all apertures are thoroughly shut on both sides a fearful howling and whistling is heard, the rain blows in through the smallest openings and the house may shake but damage is seldom done. Should a fierce squall get the chance to blow into a house, the roof is often the first part to give way. It is believed that pressure falls so quickly outside that the air confined in the house [H] bursts through the roof like an explosion, but there is no foundation for that belief; it is more likely that a fierce squall would break through the windows and doors, and through the roof as well. But if any fear is entertained of the air being confined inside, it is merely necessary to leave the chimneys open so that pressure inside [I] will be nearly the same as on the outside.

In many typhoons the barometer, reduced to the temperature of freezing water and to sea level, does not fall below 28.80 inches. In others it falls as low as 28.50. Lower readings are rare, but sometimes it falls much lower.

No typhoon ever stands still. As soon as it is formed, it is carried forward by the prevailing wind. That is why [K] the isobars are elongated, except near the center where the force of the prevailing wind is of no account. The isobars could be circular only in a stationary typhoon. That is also why [L] typhoons move so as to keep the areas of high barometer on their right, and so as to recede from areas where the barometer is high, and so as to approach low-pressure areas. Most of the typhoons that originate in the Pacific to the east of the Philippines or Formosa move westward at first, then northwest, then north, then they recurve to the northeast, and beyond Japan they move eastward. This is under the influence of the high-pressure area in the northern Pacific, around which they [M] rotate in the same direction as the hands of a watch. When there are two typhoons about at the same time, they rotate round each other in the opposite direction, that is, abstracting from the influence of the high-pressure areas, which may cause them to move somewhat differently from this simple rule. In the China Sea there is sometimes a low-pressure channel between high pressures in China and in the southern part of the China Sea. A typhoon in the Pacific at such times is attracted toward the China Sea and passes along the low-pressure channel, because the winds blowing to either side of this channel agree with the winds round the center of a typhoon, and they move according to the principle of least action.

The preceding paragraphs suggest the following notes, each of which is lettered to correspond with the capitals inserted in the text:

[A] These troughs of low pressure are common over the northern temperate zone and, doubtless, occur also in the Southern Hemisphere. They have apparently much analogy to the great equatorial trough that extends almost continuously around the globe between the northeast and southeast trade winds of the two hemispheres. Another fine example is the long, narrow trough that frequently extends northward over the peninsula of California into Arizona. Such troughs are frequent over the United States and the adjacent Atlantic Ocean. If an axis extends east and west so that the areas of high pressure are north and south of it, then the barometric depression is slight but the contrasts of temperature are very great. If the axis of the trough trends northeast and southwest, then the depression is greater but the contrasts of temperature are less. In both cases a belt of cloud overlays the trough but the rainfall is light for the east-west troughs and only moderate for the northeast-southwest troughs. In the east-west trough, the principal portion of the area of cloud is on the southern side of the trough, but in the northeast-southwest troughs the principal cloudiness is on the west of the trough. The motions of the clouds indicate that in the east-west trough the surface winds which are often north and south rise over the trough and flow back on themselves quite symmetrically, which, perhaps, explains why the southerly wind after rising and overflowing produces heavier clouds and rain on the south side of the trough than does the northerly wind on the north side. In the northeast and southwest troughs the winds on the opposite sides, viz, the northerly wind on the west and the southerly wind on the east glide past each other with much less amount of overflow, so that the

clouds on each side move from the southwest while those on the west side move from the northeast in the lower strata but from the northwest in the upper strata. Numerous references to these points in the structure of the troughs of low pressure will be found in some of the MONTHLY WEATHER REVIEWS that have been prepared by the present Editor; one of the most remarkable cases was that of February 22, 1874, described in the REVIEW of that month. Interesting cases of this kind over the land and the ocean are explained in the REVIEW for January 1894, p. 6, where the general rule is explained to the effect that when these troughs of low pressure constitute conditions of unstable equilibrium they finally break up and resolve themselves into whirls which are stable conditions; the center of the whirl which first appears at the south or west end, moves rapidly along the axis of the trough, increasing in intensity and extent until it becomes a well-marked storm center. It is very rare that a trough breaks up into two whirls, but in case it does so, the southern and western whirl is the more important and soon absorbs the other. The mechanical details of the American and Atlantic troughs must be homologous with the troughs described by Doberck in connection with the typhoons of the China Sea, and as the former frequently develop into Atlantic hurricanes so the latter develop into the east Indian typhoons.

[*To be continued.*]

BACK NUMBERS OF THE MONTHLY WEATHER REVIEW.

When requests for back numbers of the MONTHLY WEATHER REVIEW are received from those who desire to complete their sets, and it appears that the stock on hand in Washington is exhausted, the Editor will mention such cases in the REVIEW, in order that those who are able and willing to supply the desired numbers may have an opportunity to do so. Penalty envelopes will be sent to those who desire to return their copies to the Weather Bureau, and the Editor will undertake to transmit them to their proper destination.

Prof. Conway Macmillan, Botanical Library, University of Minnesota, Minneapolis, Minn., desires to obtain a series of the publications of the Weather Bureau for that library.

Prof. P. E. Doudna, of the Colorado College at Colorado Springs, Colo., wishes to complete his set of the MONTHLY WEATHER REVIEW, and then place it in the college library. He needs the following numbers:

All of 1873 to 1877, inclusive.
1878, March and April.
1880, July to the end of the year.
All of 1881–1885, inclusive.
1886, January to October, inclusive.
1887, April.
1888, January to July, inclusive.
1889, January to June, inclusive; August.
1890, May; July to December, inclusive; Summary.
1891, January to July, inclusive.

The Annual Summary, considered as the last number of the annual volume of the MONTHLY WEATHER REVIEW, was first published with the volume for 1891. The reprint of the MONTHLY WEATHER REVIEW as a part of the Annual Report of the Chief Signal Officer of the Army ceased with the report for 1883. The annual reports of the Chief Signal Officer for 1884–1891 contain the tabular summaries, by months and years, similar to those that have since then been published in the annual reports of the Chief of the Weather Bureau.

METEOROLOGY IN GREAT BRITAIN.

Mr. William Allingham, of London, communicates to the Liverpool Journal of Commerce of March 24, a review of the report of the Meteorological Council of London, for the financial year 1897–98. He states that the small sum of £15,300 sterling is all that the Council has at its disposition to spend for climatology and storm warnings, and out of this sum £1,600 is repaid to the Government as its charge for telegraphy, in addition to a small sum for postage.

Mr. Allingham mentions the large sums appropriated by Russia, £45,000, and the United States, £195,000 for similar purposes, but he forgets to compare the relative areas of the countries. According to the Statesmen's Year Book, the area of Great Britain is 121,481 square miles, and the area of the United States, including Alaska, is 3,500,141 square miles, and that of Russia and Siberia, 8,660,282 square miles. If we divide the annual appropriations for meteorology by the areas of the States, we find that Great Britain spends 60 cents per square mile, while the United States spends 28 cents, and Russia spends only 26 cents. The expense of climatology increases, but that of storm warnings diminishes, as the area increases.

Special attention is given to ocean meteorology by the British and Russian officers, but in the United States this is done by a separate organization, viz, the Hydrographic Office of the Navy. With regard to weather forecasts Mr. Allingham says that the degree of success is greater than might be expected in consideration of the proverbial fickleness of British weather; 55 per cent of forecasts were completely verified, and 25 per cent partially so. Ninety per cent of the daily forecasts of rainy or fair weather during the hay-harvest were verified; 150 stations receive, by telegraph, warnings of approaching storms and display signals; out of 596 warnings 60 per cent were justified by gales. Mr. Allingham says:

> It is stated in the report that as telegraphic information can not be received from the Atlantic, the means of forecasting certain kinds of atmospheric disturbances are necessarily wanting. Surely this is scarcely the correct way of viewing these failures. Forecasting of weather is not, or at any rate ought not to be, on all fours with the signalling of trains from station to station on a railway. Something more than this is demanded from a professional weather forecaster. The general public will have weather forecasts and every nation worth mentioning has now a state-supported weather bureau. Some idea of the importance attached to this part of the work may be obtained by the fact that at least two of the daily papers in London have special weather forecasters of their own, who compete with the state-paid officials, and one of these papers actually receives weather telegrams from several stations in England, Ireland, and Scotland, which are forwarded sometimes six hours later than those sent from the same places to the central office of the state-supported weather bureau. Consequently, under the present system of weather forecasting, this paper ought occasionally to score when the forecast of authority is a failure.

BREAKING UP OF THE ICE AT PIERRE, S. DAK.

We quote the following table from the March report of the Iowa Weather and Crop Service. It is said to be reprinted from the Sioux City Journal, which copied it from a manuscript notebook kept by Pierre Chouteau the famous trader after whom Pierre received its name. The table purports to give the dates on which the ice in the Missouri broke up at Pierre; no further details are given as to whether in some cases, as often happens, the ice breaks and again closes up, but it is fair to assume that these are the dates of the final break up in each year:

Year.	Month.	Year.	Month.	Year.	Month.	Year.	Month.
1846	April 20	1857.....	March 26	1868.....	March 25	1879.....	March 31
1847......	April 10	1858.....	April 12	1869.....	March 29	1880.....	April 7
1848......	April 9	1859.....	April 18	1870.....	April 8	1881.....	March 27
1849......	April 1	1860....	March 24	1871.....	April 2	1882.....	April 4
1850......	April 3	1861.....	April 5	1872.....	March 14	1883.....	March 24
1851......	March 24	1862.....	March 27	1873.....	March 11	1884.....	March 28
1852... ..	March 22	1863.....	March 23	1874.....	April 14	1885.....	April 3
1853......	March 29	1864.....	April 15	1875.....	March 25	1886.....	March 16
1854.....	April 5	1865.....	April 13	1876. ...	March 30	1887.....	March 12
1855.....	March 30	1866. ...	April 7	1877.....	March 16	1888.....	April 1
1856......	April 6	1867.....	April 4	1878.....	March 23	1889.....	March 18

CLEARNESS OF THE ATMOSPHERE IN ARIZONA.

The early astronomers of Persia were of course unacquainted with the telescope, and are credited with sharp vision and great persistence in the accumulation of astronomical observations. It is popularly supposed that their observations were greatly facilitated by the purity of the atmosphere in that part of the globe. The observations made at Mr. Lowell's fine astronomical observatory at Flagstaff, Ariz., have, during recent years, established the fact that no region of the globe can offer a clearer atmosphere for the observation of the stars than is to be found in that Territory. An independent confirmation of this fact is found in an observation noted in the March report of the Arizona section. Mr. G. O. Scott, voluntary observer at Tonto, in Gila County, notes that on the morning of the 7th he observed a star before sunrise, closer to the moon "than any I have seen in years." Dr. W. E. Day, voluntary observer at Prescott, Yavapai County, northwest of Tonto, noted "a star traveling along with the moon all day, plainly visible until 2 p. m. of the 8th."

The bright star seen by these two observers was undoubtedly the planet Venus. At noon on the 8th on the one hundred and twentieth meridian, or 8 p. m., Greenwich time, the moon was in right ascension 21h. 2m., and in declination S. 13° 37'. At the same time the planet Venus was in right ascension 20 h. 19m., and declination S. 18° 10'; therefore at this time Venus would appear about 5° to the north, and 10° west of the moon. It usually requires a combination of favorable circumstances to see the brighter planets with the naked eye in the daytime, but we understand that these observers in Arizona detected the planet without any special effort.

LIQUID AIR AS A SOURCE OF POWER.

During the past few weeks the Editor has received many inquiries as to the possibility of doing wonderful things with liquid air. Erroneous ideas as to the properties of liquid air seem to be rapidly spreading through the country by the dissemination of hasty conclusions emanating from those who are fond of dwelling upon the marvellous. Science is no fuller of marvels than nature herself, but neither of these deals in impossibilities. There is no doubt but that air which has been cooled and compressed until it is liquified (by methods that have been explained and practised frequently during the past twenty years by such men as Pictet, Cailletet, Wroblenski, Olzeffski, Dewar, Fleming, Linde, and Ramsay, and which methods can easily be put into operation on a commercial scale) must when it is warmed and evaporated reproduce an immense pressure that can be utilized to drive engines as we do the steam in the ordinary boiler. Water expanding into steam at ordinary atmospheric pressure and temperature increases its volume by about 1,700 times. Liquid air expanding under the same conditions will occupy 800 times its volume. If this expansive power is converted into mechanical energy, the gallon of liquid air will do about 1,500,000 foot pounds of work. If this work is accomplished in one hour, it will represent about 25,000 foot pounds per minute, and is, therefore, equivalent to about three-fourths of a horsepower working continuously for an hour.

But it has been argued that liquid air being so cold is warmed up by the radiation of heat into it from all surrounding objects, and, therefore, we shall not need to burn expensive fuel in order to convert it into gas. While this may be true, yet it is also true that the surrounding heat will penetrate the liquid air so slowly and evaporation will take so long a time that the process would become exceedingly wasteful. A steam engine of 10-horsepower is of little use in ordinary work unless it can be brought into a state of full efficiency within an hour after lighting the fire and be kept in that state of efficiency continuously. The liquid air engine that draws upon surrounding objects for its heat would be the feeblest imaginable machine. A 10-horsepower engine is useless if you give it no hot steam; its usefulness increases in proportion as hot steam can be rapidly supplied to the cylinder in order to produce a quick succession of powerful strokes. A horsepower is an expression that involves two ideas, viz, the raising of 33,000 pounds one foot and the doing of this in one minute. The power diminishes both in proportion as the work that is done is less and in proportion as the time required is greater.

With regard to the expense, it may be stated that at the present time the cost of manufacturing liquid air is said to be 20 cents a gallon and the advocates of the liquid air motor propose to expend nothing for fuel since they would draw their heat from nature. On the other hand, the advocates of the steam engine get their water from nature for nothing and have to pay about one cent for the fuel and expenses. Even if they paid four cents for the necessary fuel, still the liquid air machine would be five times as expensive. The principal manufacturer of liquid air on a commercial scale, viz, Mr. Tripler, of New York, states that he requires a 50-horsepower engine in full activity for a day (presumably ten hours) to make 50 gallons of liquid air. This is at the rate of one gallon per 10-horsepower per hour. There is, of course, a great deal of power lost by friction and leakage, which waste may amount to 25 or 50 per cent, or even more, of the power employed.

Now let this gallon be put into the boiler of a liquid air motor and made to do work. If we supply heat to it as rapidly as was done by the fire of the original steam engine, it will expand rapidly and can be made to do such work, for instance, as the manufacture of more liquid air. The gallon of liquid will, of course, be rapidly evaporated in its little boiler and soon be entirely consumed; let the heat be so regulated that it shall last just one hour; at the end of that hour we shall find that the original gallon of liquid air has been instrumental in developing about three-fourths of a horsepower per hour, in accordance with the law of mechanics as above stated. This can manufacture only three-fortieths of a gallon of liquid air, since in Mr. Tripler's most efficient machine 10-horsepower per hour can only make one gallon per hour.

If we suppose the gallon of original liquid air in its little boiler to be heated, not by expensive coal, but by the cheaper heat conducted and radiated from all surrounding objects, this would be a slow process; it may take several hours for the evaporation to be completed, and we should, therefore, be subject to a greater loss from friction and leakage, and at the end of several hours should have even less liquid air to show for our mistaken effort at economy. In this case the time required is so much greater than one hour that it wholly destroys the efficiency of the machine.

A fuller exposition of liquid air fallacies is given in the Scientific American by Prof. Henry Morton, President of the Stevens Institute at Hoboken.

It may be worth while calling attention to the fact that similar argumentation holds good in reference to the so-called solar motors. It is perfectly possible to boil water in a closed vessel at the focus of a great mirror or lens by means of the concentrated solar rays and work may be done by the steam thus generated, but the inflow of heat is not sufficiently rapid to give these solar machines much value as compared with the steam engine or even the windmill. In fact, the windmill is an efficient form of the solar machine. In this case the whole atmosphere represents the steam, and the earth's surface represents the lower side of a boiler, while the windmill works like the cylinder and piston placed inside of the boiler. In the MONTHLY WEATHER REVIEW for April, 1895, p. 131, the Editor called attention to the propriety, and even

the necessity, of establishing a governmental bureau for investigating and reporting upon the efficiency of the machines and tools that are used by the farmers. The need of such an institution is now felt all the more as a safeguard against imposition in connection with these proposed new motors and new methods of manufacturing power out of nothing.

DUST WHIRLS AND FAIRY DANCES.

Mr. O. C. Pepoon, of Medicine Lodge, Barber County, Kans., sends the following description of a dust whirl observed at that place in the summer of 1897:

In the summer of 1897, the exact date is forgotten, at about 3 p. m., I noticed a whirlwind moving from the northwest to the southeast. It was in every way similar to an ordinary whirlwind, including the straight wind which accompanied it, except that instead of one circular wind five small whirlwinds whirled around a common centre. Each whirlwind resembled an ordinary whirlwind in form and velocity. They whirled on their individual axes, also on their common axis to the right. The whirlwinds were about 15 feet high.

The day was clear, warm, and still, with occasional gusts, from different directions generally westerly. The whirlwind was first seen at the northwest corner of a field of last year's stubble, at the north end of an 8-foot osage orange hedge, running south.

The whirlwind ran a few rods and vanished.

The diagram accompanying this article by Mr. Pepoon shows that the system of little whirls revolving about a common center was formed on the leeward side of the hedge to which he refers. These whirls were undoubtedly due in part to the presence of the hedge, since similar whirls are encountered in the rear of every obstacle. But they were also due in part to the hot, dry surface of the ground, since every small mass of air that is heated hotter than its neighbor rises and carries the lightest dust with it. Pictures of similar and many other forms of dust whirls are given in the volume of plates accompanying the work on Whirlwinds and Duststorms of India by P. F. H. Baddeley, London, 1860. He gives diagrams showing several dust whirls rushing along one after the other until finally all combine into one large whirl; or again, a group of thirty or forty whirls forming a continuous series like the front of an advancing squad of soldiers, or even circling around a central region like the outside boundary of a tornado. His diagrams suggest that in some cases a circle of dust storms, representing ascending whirls, incloses an area in which the air is descending, but this may be a hypothesis of the author and not the result of actual observation. Baddeley was a very enthusiastic student of the subject, and followed these whirls on horseback or in a buggy, note book and pencil in hand, noting and sketching as he went along. He attributes to electrical action the phenomenon that we believe can easily be explained without electricity as being due simply to the wind and the heat. He says that:

Dust whirlwinds are common in all parts of India, especially during the dry season. Sometimes a slender lofty cylindrical pillar of dust is seen revolving on its axis, or several such pillars moving on together in the same direction, or revolving in a circle, or as a dense cloud of dust sweeping over the country like a tornado, the cloud of dust occasionally presenting to the view a distinctly columnar structure. In northern India the smaller whirlwinds appear in dry, windy weather. They occur with singular regularity during the middle of the day. Sometimes a slowly-moving whirlwind instead of appearing as a simple column is found to be composed of several distinct vortices, each one rotating on its axis as it revolves around in the whirling circle. Each separate vortex has attached to it a fan-shaped train of dust.

This remarkable sight gives the idea of a fairy dance round a ring, and the motions are, from all accounts, exactly imitated by the dancing Dervishes of Turkey, one of their holy exercises being to whirl round and round like a top, singly, or in company with several others, performing at the same time a gyration round in a circle, as if their dance originated in the very phenomenon now described. We may sometimes watch this motion for a length of time without changing our position more than a few yards.

Mr. Baddeley says that—

The essential portion of the whirlwind always appeared to him as a lofty cylindrical pillar preserving apparently the same diameter throughout its entire height for thousands of feet. A dust storm or tornado is occasioned by an accumulation of whirlwind columns moving en masse or in rapid succession over the earth's surface in a direct or wavy line. Thousands of these spiral columns pass by in one direction during six or seven hours of the hottest portion of the day, and on other days repass in another direction as if a host was mustering for battle.

Among the numerous details given by Baddeley, we quote the curious fact stated by him:

Birds, such as kites and vultures, are often seen soaring high up just above and around these dust whirlwinds, following them for some distance, soaring about and around them, diving at each other as if in sport, keeping pace with them, seemingly with no other purpose than that of enjoyment.

The reader will find a very interesting description of mechanical methods of forming whirling columns of air with the attending dust whirls and waterspouts in a French work on Tourbillons, by Weyher. The method adopted by him consists in placing a wheel or fan at some distance above a basin of water or table covered with dust. The rapid horizontal rotation of the fan sets all the air of the room in motion, producing a spiral ascending whirl over the table, having a crude resemblance to a dust whirl, waterspout, or tornado.

Much more natural imitations of the atmospheric dust whirls have been made and described by Vettin in the Annalen für Physik und Chemie for 1856 and 1857. Experiments of this kind have lately been carried out quite perfectly by one of America's most skillful experimentalists, Prof. R. W. Wood, of Madison, Wis. (See an article by him entitled Some Experiments on Artificial Mirages and Tornadoes, L. E. D. Phil. Mag.. April, 1899, Vol. XLVII, p. 349.) Professor Wood uses flat metal plates about a yard long and a foot wide covered with a little sand. By heating the plates the air above the sand becomes warmed and produces mirage effects; but when heated still hotter most beautiful little whirlwinds of rising hot air can be seen running about over the surface and carrying up the fine silica powder that is scattered upon the plate. When sal ammoniac is used instead of silica, dense clouds of white vapor immediately arise, and he has observed a most perfect miniature tornado of dense smoke about two yards high.

The preceding notes suffice to show how eddies and whirls of dust are formed on the hot plains of Kansas. It seems natural to infer that special combinations of winds and temperature may give rise to the large whirls or waterspouts and tornadoes, but we think it more likely that the latter have an analogous but slightly different origin. The solar rays that heat the ground on a clear day have an effect analogous to that of those rays that are stopped by the clouds in ordinary weather. In the formation of a waterspout, it is quite common to see its slender axis form at the base of a cloud and descend toward the sea level. This has been properly explained by Ferrel, who showed that the velocity of gyration can easily be very much greater high above the earth's surface than lower down, and that the cloud that is formed in the region of low pressure along the axis of the whirl must begin at the upper end of the waterspout and grow downward. The whirls in both waterspouts and tornadoes are, therefore, explained mechanically as originating in the clouds and extending downward, under favorable conditions, to the earth's surface. It is only the small dust whirls that originate at the earth's surface and only in rare cases do these extend upward to the clouds.

MONTHLY CHARTS FOR THE WEST INDIES.

We are pleased to be able to present in the accompanying charts, XII and XIII, a first attempt to draw monthly iso-

bars and isotherms for the West Indies, the Caribbean Sea, and the Gulf of Mexico. Probably the most interesting station on this chart is that of Colon, at which point the observations give us clear evidence that the equatorial belt of low pressure on the Pacific Ocean here crosses over into the Caribbean Sea. There can be no doubt but that the flow of northerly winds over the United States is often due as much to a deficiency of pressure in the Caribbean Sea or in Brazil as to an excess of pressure in North America. The study of the equatorial regions is certainly quite as important to the meteorologist as the study of the polar regions, a phase of the question that was especially dwelt upon in 1881 when discussing the necessity of the great international polar work. It is to be hoped that the publication of these charts, which have been kindly prepared by Mr. A. J. Henry, will prove of great service in attracting attention to the meteorology of this portion of the globe. We have on many occasions explained in the Monthly Weather Review how this eastern end of the Pacific trough of low pressure turns northward in the summer season and reaches into Arizona. In that Territory, as at Colon, the low pressure is not a direct result of local temperature, but is a feature that belongs to the general circulation of the atmosphere.

Beginning with the month of March we hope to be able to complete the western portion of this map by making use of the data published on the daily and monthly maps of the Mexican service.

THE AMERICAN METEOROLOGICAL JOURNAL.

The Editor has received from one of our voluntary observers, a request for Vol. I, No. 1 of the American Meteorological Journal, and not being able to supply this number, takes the liberty of making this request known, in hope that some one may have a copy to spare.

The librarian of the Weather Bureau would like to obtain Nos. 1, 2, and 3 of Vol. II.

Prof. H. A. Hazen would like to obtain a personal copy of Vol. II, No. 2.

In general, copies of Volumes IX-XII may be purchased of the publisher by those who wish to complete their sets.

VERTICAL TEMPERATURE GRADIENTS.

Mr. J. S. Hazen, voluntary observer at Springfield, Mo., notes a remarkable difference of temperature within 90 feet of the ground at that place on March 26. He says:

The station thermometer is located in its shelter, 90 feet above an extra thermometer, which latter was 3 feet above a level lawn. The following comparative readings were taken:

Time.	Thermometer.		
	In shelter, 93 feet above lawn.	3 feet above lawn.	Difference.
	°	°	°
9 a. m.	32.2	36.5	4.3
10 a. m.	33.0	37.4	4.4
11 a. m.	33.0	37.7	4.7
12 a. m.	33.3	38.5	5.2
1 p. m.	33.5	38.9	5.4
3 p. m.	35.0	40.6	5.6
4 p. m.	34.2	39.0	4.8
5 p. m.	34.0	35.1	1.1

The observer's attention was first called to the peculiar condition by noticing that the trees and various other objects were covered with a heavy coating of ice down to about twenty feet from the ground, while the lower branches of the trees and the surface of the ground was entirely free from any evidence of ice.

The night of the 25-26th was cloudy, with light fog early in the the morning and the day following. The humidity was high, and the air impressed one as being damp, heavy, and penetrating.

Two thunderstorms of slight intensity occurred during the 26th, one shortly before 11 a. m., and the other about 2 p. m., and both were accompanied by hail. The hailstones were about the size of peas.

The line of demarcation between the warmer surface air and colder air above was sharply and distinctly drawn, but the colder air gradually encroached upon the warmer body of air. It was noted that during the first hailstorm the ice remained in the sloping gutter of a shed roof down to about twenty feet above the ground, but after the second storm the ice was extended down to within less than ten feet from the surface of the ground, while lower than that no ice remained.

It is believed from the amount of ice on the trees that the temperature was probably lower at a height of about fifty feet from the ground than it was in the instrument shelter, but there was no way of taking the temperature at that elevation. Ice began to form on the ground shortly after 8 p. m.

It has been suggested that—

If the air at the surface of the ground was unusually dense, by reason of pressure and humidity, still the cold brisk breeze a hundred feet above the ground would force a mixture between the cold air above and the warm air below in a very short time. It is, therefore, considered by some as remarkable that the colder air above should have encroached so gradually upon the warm air below.

The Editor would remark that the question is not one of pressure or humidity but of temperature, and that our first consideration must be to ascertain the relative reliability of the observed temperatures at 3 and 93 feet, respectively, above the lawn. On this point a letter of inquiry was immediately addressed to the observer who replied:

The temperature was obtained from a standard Weather Bureau thermometer, which was attached to a small stake, driven into the ground. There was no covering or obstructions around the thermometer, but as the weather was densely cloudy, the exposure was deemed good. There was a clear lawn space around the instrument of at least 50 feet.

As this exposure of a thermometer is wholly unsatisfactory, it would be improper to attempt to draw any refined conclusions from the comparison of the upper and lower temperatures.

When questions of a few degrees Fahrenheit are propounded in meteorology, the method of determining the temperature of the air is of paramount importance. Every one who has examined the subject now recognizes the fact that a thermometer does not show the temperature of the air unless all injurious radiation has been annulled either by protecting screens or by a rapid flow of air, or by the rapid whirling of a thermometer. In the present case, it is quite plausible that the temperature at the level of the lawn between 9 a. m. and 5 p. m. was higher than at the level of the instrument shelter 93 feet above the lawn, but the amount of this difference in degrees can not be satisfactorily deduced from these observations. It is not likely that the true difference was very large because, as the observer states, the weather was densely cloudy. The only way in which this difference could be determined with an accuracy of one-half a degree Fahrenheit, would be by using standard thermometers at the upper and lower station, well screened against all radiations, and well ventilated either by the natural wind or by whirling them, as with a sling psychrometer, or by causing a rapid indraught as in the Assman psychrometer. A full description of the various methods of determining the temperature of the air is given in the Editor's Treatise on Meteorological Apparatus and Methods, published as Part 2 of the Annual Report of the Chief Signal Officer for 1887. Recent special investigations have been published by the Seewarte at Hamburg and the Meteorological Office at Berlin.

Errors of several degrees Fahrenheit are liable to be incurred when a thermometer is simply hung in the open air without protection from radiation and without special ventilating currents. In the present case if the trees and other objects twenty feet above the ground were covered with ice and the sun's rays did not penetrate through the thick clouds, we should naturally expect that streams of cold air from the ice would settle down to the ground, and that the temperature at 3 feet above the lawn would be as cold, if not colder, than

that at 93 feet above. But in fact there is always a strong radiation to the ground from a layer of cloud. The sun heats the upper surface of the clouds, and by convection the influence of this heat is felt at the lower surface, which latter is also warmed or cooled, as the case may be, by radiation between it and the ground. One may often notice how rapidly the ground dries up as the fog lifts, although the sun is still invisible. It is evident that something of this kind took place in the present case since the lower thermometer was warmer than the upper thermometer by a quantity that kept on increasing up to 3 p. m. and then rapidly diminished. The wind near the ground was too feeble to nullify the radiation from the lawn. It was much stronger at the 93-foot level. The upper thermometer gave the temperature of a general layer of wind; the lower thermometer had a temperature due to radiation from the lawn, and not necessarily the temperature of the lower air.

In conclusion we may say that this unusual difference of from 4° to 6° in a vertical distance of 90 feet, even if it were demonstrated by unexceptionable apparatus to really exist is not an *inversion*, as the observer called it, of the ordinary vertical temperature gradient. The ordinary gradient is defined as being a diminution of temperature with increasing height above ground, and that is what was recorded in the present case. An *inversion* is an increase of temperature with height above ground, such as occurs during a few hours in the early morning under a clear sky, and especially when hoar frost is deposited from still air.

When the vertical gradient is a diminution at the rate of 1° C. for 99 or 100 meters, or 1° F. for 183 or 187 feet, this is called the adiabatic gradient and the air is said to be in a state of neutral equilibrium, because a mass of it raised or lowered by any number of feet will be cooled by expansion or warmed by compression to such an extent as to have the same temperature as the surrounding air in its new locality; hence the air whose location has thus been changed has no tendency to move from the place to which it has attained. On the other hand, if the rate of diminution with ascent is greater than 1° for 187 feet, as in the present case, where it was, at 3 p. m., 1° for 16 feet, then the upper air has a tendency to descend, and the lower air a tendency to ascend and to keep on ascending or descending indefinitely, so that the air is said to be in a condition of unstable convective equilibrium, such as occurs in the hotter portion of every clear day near the surface of the earth.

If the rate of descent is less than 1° for 187 feet, and especially if it becomes negative, that is to say, colder below and warmer above, then the air is in a state of stable equilibrium, and if raised or lowered tends to return to its original position.

UTILIZATION OF FOG.

On page 101 of this number of the MONTHLY WEATHER REVIEW we publish an interesting article by Mr. A. McL. Hawks, C. E., of Tacoma, Wash., on the subject of the utilization of fog for irrigation on the coast of southern California. His communication was suggested by the remarks of the Editor, published in the MONTHLY WEATHER REVIEW for October, 1898. Mr. Hawks states very truly that expensive mechanical means for collecting the fog will not be practicable. Indeed, the Editor substantially said the same thing in October, and suggested that some simple method be devised for catching the fog and forcing it to drip to the roots of the plants as useful water.

The use of liquid air, as suggested by Mr. Hawks, would undoubtedly be one of the most expensive methods of catching the fog and there is room for grave doubt whether any fog at all could be condensed by its use. Liquid air is the remarkable product of a powerful steam engine and appropriate apparatus. When manufactured, even on a large scale, it is not likely to cost less than 25 cents a gallon or to be sold for less than double that price. If one simply needs to have a cooling agent in order to condense the fog into drops, one might, far more economically, make use of artificial ice or the original brine bath and the ammonia coils of a refrigerating apparatus. The evaporation of liquid air back into the free atmosphere, which is the experiment that is now being daily shown to hundreds of people, does not produce the least sensible influence on the temperature of the audience chambers where the experiments are performed and would have still less effect over the orchards of southern California.

Mr. Hawks suggests a second method for attacking the problem, viz, the construction of a flue or smokestack leading from the cooler air above the fog down through the warm air to the earth's surface, in order that the cold air may descend through it to the ground. But the upper cold air really does not need any such conducting flue, it will descend of itself if the conditions are proper; otherwise, it can not be brought down except by the use of some extraneous expensive force and if brought down would be warmed up so much by the compression due to the greater barometric pressure near the earth's surface that it would not produce rain, but become a veritable warm, dry chinook.

But there is a third and most valuable suggestion in the letter of Mr. Hawks. He has observed that shiny black-painted iron or shiny freshly painted boards exposed horizontally are great moisture gatherers. It is evident from his statements that a concave painted board or a concave sheet or trough of painted iron will collect much moisture. If such a concave surface has a gentle inclination toward the ground, the moisture should drip in a steady stream all night long from the lower end, and can, therefore, be gathered in reservoirs or pails or led directly to the roots of the plants. This drip, as we stated in the October REVIEW, is that which maintains the verdure of Green Mountain on the Island of Ascension. It is well worth while for the agriculturists of southern California to follow out this line of experiment in the matter of utilizing the fog.

THE BLUE COLOR OF THE SKY.

The March report of the Montana section contains an interesting article by A. H. Thiessen, on the cause of the blue color of the sky. This was first explained by Rayleigh as probably due to the so-called selective reflection of the blue light in a beam of sunshine by the finest particles of aqueous vapor and dust. Mr. Thiessen gives a very simple statement of Rayleigh's explanation and we quote the following from his article:

On a cloudless day when looking away from the sun toward the sky we observe its blue color. We are then looking into space, but our line of sight is intercepted by a multitude of dust particles suspended in the air. The color of these particles is observed to be blue. This is due to their reflecting to our eyes the blue rays against which they form an effective barrier, while the red or coarser waved rays pass on.

The color of skylight is due then to the reflection of the shorter wave lengths to the eye. The air itself has no power to reflect light, but it contains innumerable dust particles which present a vast reflecting surface to the light waves. That the dust reflects back only the blue rays is due to their microscopic size. The finer the dust then the purer is the blue which is reflected or scattered. One may expect then to find the bluest skies in those places where the dust particles are smallest, and it is true that the blue of the sky as seen from the tops of mountains is deeper and purer than that seen from a lower altitude. This is due to the fact that the air is very rare at great heights and can only sustain the finer particles of dust, while the coarser particles abound at the lower levels. The sky of Italy is noted for its clearness. The blue is deeper, not because the dust there is finer than in the northern countries, but because in the countries of the north, due to the greater

coolness of the air, the vapor more readily condenses upon the dust particles. The dust particles thus become larger and consequently not so effective in turning back the blue rays alone, but others are also reflected and a grayish effect is produced. In a single location the blue of the sky may appear bluer at one time than another. The sky is oftentimes said to be very blue when some white cumulus clouds are outlined against it. The sky is then a deep blue by contrast with the brilliant white. After a shower, when the lower stratum of air is washed of its coarse dust particles, a deeper and purer blue is the result.

As one looks toward the sun, especially at sunset, the reds are prominent. The dust particles are then between the sun and the observer, and so the blues are reflected away from the observer while the reds pass on to the observer's eye. One might suppose that the sun ought to appear red rather than white when one looks directly at it, because the stratum of air containing the dust is between the observer and the sun and thus there would be a diminution of the shorter wave rays to the eye. This is explained by assuming that the sun is really blue if observed from a point beyond our atmosphere; the subtraction of the blue rays as they are scattered by the particles in our atmosphere is just sufficient to produce the white sun as it appears to us.

The same mail brings us the latest contribution of Lord Rayleigh to this subject, viz, an article published by him in the April number of the L. E. D. Phil. Mag. (5) XLVII, pp. 375-384. In this article Lord Rayleigh shows that we may not need to have recourse to the suspended particles of foreign matter, solid or liquid, but that in the absence of these we should still have blue sky if the molecules of the atmospheric gases are large enough or massive enough to produce either diffraction or selective reflection. The same train of argument can be applied to the case of a beam of light passing through a shower of falling raindrops or through a mist or a cloud. As an illustration the following example is computed. Let a be the radius of a raindrop or cloud particle, expressed in centimeters as the unit of length; n the number of drops per cubic centimeter; x the length of path of the ray of light through the cloud. Then the length of path required in order to reduce the intensity of the light from 1 down to 0.37, or in the ratio 2.7 to 1 is given by:

$$x = \frac{1}{n \pi a^2}$$

Suppose that $a = \frac{1}{20}$ of a centimeter and $n = \frac{1}{1000}$ that is to say, suppose there is one drop of 1 millimeter in diameter for every liter of space, then the transmitted light will be reduced to one-third (0.37) of the original intensity when it has passed through 1 kilometer of the resulting hazy air. According to this theory a distant point of light seen through a shower of rain ultimately becomes invisible, not by failure of definition, but by loss of intensity (either the absolute intensity or that relative to the intensity of the scattered light in the neighborhood of the object) due to the diffractive action of the raindrops or fog particles.

Lord Rayleigh adds:

> If the view suggested in the present paper that a large part of the light from the sky is diffracted from the molecules themselves be correct, then the observed incomplete polarization at 90° from the sun may be partly due to the molecules behaving rather as elongated bodies with indifferent orientation than as spheres of homogeneous material.

ABSTRACTS OF UNIVERSITY THESES.

In order to attain the degree of Master of Arts or Master of Science, and especially that of Ph. D., all universities require the candidates to submit theses upon special subjects which they have investigated in their courses of study. These theses often contain facts and principles of general importance to science. In European universities it is quite common for such theses to be published, and as we have remarked in the MONTHLY WEATHER REVIEW for September, 1898, page 413, the thousands of theses that have been published within the past century constitute an important portion of the grand structure called science. In so far as the theses at American universities bear upon the work of the Weather Bureau, the Editor will be glad to receive from the authors either full abstracts or the originals for publication in the MONTHLY WEATHER REVIEW. The number of theses submitted by successful candidates for the degree of Ph. D., in the summer of 1898, in some branch of science was as follows:

Chicago	12	Wisconsin	2
Yale	11	Bryn Mawr	1
Johns Hopkins	19	Leland Stanford, Jr.	2
Harvard	11	Nebraska	2
Pennsylvania	8	Brown	1
Columbia	10	California	1
Cornell	11	Columbian	1
Clark	12	Minnesota	0
Michigan	0		
New York	1	Total	105

In addition to the universities we must also consider the schools of technology, thus, in the catalogue of the Massachusetts Institute of Technology for the year 1898-99, we find enumerated 204 theses of successful candidates, five of whom took the degree of Master of Science, while the remainder took the degree of Bachelor of Science. The thorough courses of instruction in dynamics, thermodynamics, hydraulics, and pneumatics given at this institution justify the hope that among these many candidates there must be at least a few whose attention has been turned toward the problems of meteorology.

STORM CENTERS IN THE PACIFIC.

The Pilot Chart of the North Pacific Ocean for the month of May, 1899, contains a synoptic weather chart of the eastern portion of the North Pacific Ocean for Greenwich noon of March 7, 1898. This is one of the few cases in which a fairly satisfactory synoptic chart has been published showing the isobars and winds around a storm center in the North Pacific. The abundance of reports received by the U. S. Hydrographic Office, will, we hope, encourage that important office to compile and publish such charts daily, for there could be no more important contribution to our knowledge of the meteorology of the ocean. In the present case an important storm center is shown to be central at N. 33°, W. 132°, midway between San Francisco and Honolulu, directly in the path of many sailing vessels and steamers. The daily map of the Weather Bureau shows that at this time the low area extended eastward across the Rocky Mountain Plateau region, and that storm centers were also present there. This is, therefore, a case of a very long oval, almost a trough, stretching in a northeast or east-northeast and southwest direction, between the tropical high area on the Pacific and one that at that time prevailed in the eastern portion of the American Continent.

The mere fact that such extensive troughs, containing several special centers of low pressure, can exist for several days, moving as a whole eastward, while the individual lows may move either southeast or northeast, suffices to show that the thin layer of air near the surface, within which the clouds and rain and high winds occur, is but a small portion of the whole atmospheric disturbance. The latter generally begins with a trough of low pressure and but slight cloudiness; as the clouds rapidly increase and the sun's heat is absorbed by them, the lower winds increase, the pressure falls, rain sets in, and special low areas develop within the trough.

The special low centers and cyclonic winds may be formed, according to Espy's and Ferrel's views, as a consequence of the formation of clouds and rain, and the disturbance of thermal equilibrium, but the original trough of low pressure appears to be a mechanical result of the general circulation of the atmosphere which forms the several tropical areas of high pressure and the troughs that separate them, including

the equatorial trough as the general separation between the Northern and Southern Hemisphere, and including the polar areas of low pressure. Buchan's chart of isobars for March shows three centers of high pressure in the Southern and four in the Northern Hemisphere; two ovals with three centers of low pressure in the Northern Hemisphere, one in the south polar region, and one equatorial trough, having two or three centers within it.

The relation between special troughs and storm centers over the Atlantic Ocean is explained on page 6 of the MONTHLY WEATHER REVIEW for January, 1894. Troughs occur very frequently over the eastern portion of the North American Continent.

CORRIGENDA.

Mr. Curtis J. Lyons desires to make the following corrections applicable to the Honolulu records for some time past:

The wind force is given on the Beaufort scale: 0–12. At the head of the column the word maximum should be omitted.

The mean dew-point and relative humidity for the month is as given by the formula:

$$(6 \text{ a. m.} + 9 \text{ a. m.} + 2 \text{ p. m.} + 9 \text{ p. m.}) \div 4.$$

The ground is 43 feet and the barometer cistern 50 feet above sea level.

The mean pressure for the month, as deduced from twenty-four hourly observations, is 0.01 higher than the mean pressure at 1 p. m. Greenwich time, or 2:30 a. m. Honolulu time.

The mean of maximum temperatures for February, 1899, is 78.5°, and not 77.0°.

February REVIEW, page 41, second column, third line from bottom, for "12th" read "11th." Last line, for "night" read "morning."

Page 42, second column, first line, for "night" read "morning." Second line, for "Sunday" read "Saturday."

Page 42, first column, table, for Galveston, instead of "6" read "8° F. at 10 a. m. of the 13th; departure below the previous lowest, 3° instead of 5°.

THE WEATHER OF THE MONTH.

By ALFRED J. HENRY, Chief of Division of Records and Meteorological Data.

March, 1899, was for the most part a wintry month—cold and disagreeable in the northern sections, with a surfeit of rain in the southern Appalachian region, and frequently alternating periods of fair and stormy weather from the Atlantic to the Pacific.

Notable characteristics of the month were: (1) The termination of the drought in California; (2) the large number of lows that moved from the Pacific to the Atlantic; and (3) the shifting of the Plateau high to Manitoba.

The rains in California up to the 15th of the month had been scanty and disappointing. In southern California the water famine had begun to assume serious proportions, the supply for domestic purposes in some places being inadequate to the demands. The rains from March 15 to the end of the month were especially timely. Persons familiar with the conditions that have existed during the last eighteen months assert that if rain had been delayed ten days longer there would have been total failure of all crops, as was the case in some localities last year.

The number of lows that passed across the country from the Pacific to the Atlantic was much greater than usual for the season, and the paths traveled were considerably south of the normal course. Six storms in all can be traced from ocean to ocean, each of which was accompanied by heavy and quite general precipitation in some part of its course. An unusual condition, viz, the fall of rain or snow simultaneously from the Atlantic to the Pacific, was observed on the morning of the 14th, the storm center being in western Kansas and eastern Colorado. It is quite likely, however, that the precipitation in some parts of the storm area was due to the influence of secondary depressions that had either filled up or united with the main storm on the morning of the abovenamed date.

Severe local storms and tornadoes occurred on the 3d and 4th in South Carolina, Georgia, Tennessee, and northern Alabama; on the 15th in northern Alabama and Georgia; on the 18th in Alabama, Georgia, Mississippi, and Arkansas; on the 22–23d in Georgia; on the 27–28th in the Carolinas, Georgia, and Alabama.

On the 3d and again on the 27th local storms began in the Carolinas before they were observed in Georgia and Alabama. The position of the general storm center with reference to the region of severe local storms, however, remained nearly constant.

The general character of the month will be seen from a study of the following tables:

TEMPERATURE OF THE AIR.

Average temperatures and departures from the normal.

Districts.	Number of stations.	Average temperatures for the current month.	Departures for the current month.	Accumulated departures since January 1.	Average departures since January 1.
		°	°	°	°
New England	10	33.0	0.0	− 2.2	− 0.7
Middle Atlantic	12	40.3	+ 0.9	− 5.7	− 1.9
South Atlantic	10	56.0	+ 2.3	− 3.0	− 1.0
Florida Peninsula	7	67.1	+ 1.4	− 0.2	− 0.1
East Gulf	7	59.8	+ 1.5	− 8.6	− 2.9
West Gulf	7	59.4	+ 1.6	− 8.2	− 2.7
Ohio Valley and Tennessee	12	43.8	− 0.2	−10.4	− 3.5
Lower Lake	8	31.6	− 0.7	− 5.8	− 1.9
Upper Lake	9	21.5	− 5.0	−11.8	− 3.9
North Dakota	7	8.8	−11.7	−13.8	− 4.6
Upper Mississippi	11	29.5	− 6.4	−13.2	− 4.4
Missouri Valley	10	27.6	− 8.3	−13.1	− 4.4
Northern Slope	7	21.3	−10.6	−18.6	− 6.2
Middle Slope	6	38.0	− 4.3	−13.4	− 4.5
Southern Slope	6	49.6	− 0.8	−11.5	− 3.8
Southern Plateau	9	51.5	− 0.3	− 1.5	− 0.5
Middle Plateau	13	38.9	− 0.9	+ 2.3	+ 0.8
Northern Plateau	10	36.0	− 2.2	− 1.8	− 0.6
North Pacific	9	42.7	− 2.6	− 2.3	− 0.8
Middle Pacific	5	51.2	− 1.1	+ 1.7	+ 0.6
South Pacific	4	55.4	− 1.2	+ 1.9	+ 0.6

PRECIPITATION.

The numerical values of total precipitation and total depth of snowfall are given in Tables I and II, and the geographic distribution is graphically shown on Charts III and VIII. The depth of snow on the ground is also shown on Chart IX.

Average precipitation and departures from the normal.

Districts.	Number of stations.	Average.		Departure.	
		Current month.	Percentage of normal.	Current month.	Accumulated since Jan. 1.
		Inches.		*Inches.*	*Inches.*
New England	10	6.89	173	+2.9	+3.0
Middle Atlantic	12	5.28	133	+1.3	+2.7
South Atlantic	10	3.10	69	−1.4	+1.1
Florida Peninsula	7	1.73	61	−1.1	+2.7
East Gulf	7	4.34	73	−1.6	−1.8
West Gulf	7	1.36	40	−2.0	−2.5
Ohio Valley and Tennessee	12	6.85	157	+2.5	+1.9
Lower Lake	8	3.81	146	+1.2	+0.1
Upper Lake	9	2.18	105	+0.1	−1.7
North Dakota	7	0.75	79	−0.2	−0.9
Upper Mississippi	11	2.51	109	+0.2	−0.6
Missouri Valley	10	1.67	94	−0.1	−1.1
Northern Slope	7	1.31	162	+0.5	+0.7
Middle Slope	6	1.28	81	−0.3	−1.1
Southern Slope	6	0.19	16	−1.0	−2.7
Southern Plateau	9	0.21	26	−0.6	−1.4
Middle Plateau	13	2.13	160	+0.8	+0.7
Northern Plateau	10	1.53	94	−0.1	−0.2
North Pacific	9	3.91	68	−1.8	+3.0
Middle Pacific	5	6.79	166	+2.7	+0.2
South Pacific	4	3.30	143	+1.0	−1.1

HAIL.

The following are the dates on which hail fell in the respective States:

Alabama, 2, 4, 5, 17, 18, 19, 20, 28. Arizona, 16, 25, 29. Arkansas, 3, 4, 17, 18, 22, 26, 27. California, 2, 8, 9, 12, 15, 16, 20, 21, 22, 23, 28. Colorado, 1, 25. Florida, 23, 29. Georgia, 2, 4, 5, 18, 19, 23, 25, 28. Illinois, 1, 3, 4, 18, 19, 20, 22, 27, 28. Indiana, 3, 8, 18, 22, 26, 27. Indian Territory, 27. Kansas, 11, 17, 18, 30. Kentucky, 1, 3, 4, 15, 17, 19, 21, 22, 25, 26, 28. Louisiana, 4, 5, 12, 14, 18, 28, 30. Maryland, 5, 12. Massachusetts, 12. Mississippi, 4, 14, 18, 22, 27, 30. Missouri, 3, 4, 11, 14, 17, 18, 25, 26, 27. North Carolina, 2, 3, 4, 31. Ohio, 15, 22. Oregon, 1, 2, 7, 8, 9, 11, 12, 13, 14, 20, 21. Pennsylvania, 15. South Carolina, 3, 5, 27, 28. Tennessee, 2, 3, 4, 5, 11, 18, 22, 26, 27, 28. Texas, 13, 18, 27, 28. Utah, 1, 3, 13, 29. Virginia, 2, 3, 14, 27. Washington, 2, 3, 11, 20, 21, 25, 26, 27. West Virginia, 2, 15, 19.

SLEET.

The following are the dates on which sleet fell in the respective States:

Alabama, 6. 7. Arkansas, 18, 27. California, 2, 8, 9, 12, 15, 16, 20, 28, 29, 31. Colorado, 2, 19, 20, 21, 22, 23, 24, 26, 27. Connecticut, 2, 4, 15, 18, 19, 22, 23. Georgia, 6, 7, 29. Idaho, 1, 3, 9, 20, 21, 28, 29. Illinois, 1, 3, 4, 14, 18, 19, 22, 26, 27, 29, 30, 31. Indiana, 1, 2, 4, 5, 17, 19, 21, 22, 25, 26, 27, 28, 29. Indian Territory, 27. Iowa, 1, 2, 10, 11, 12, 14, 17, 18. Kansas, 10, 11, 14, 25, 26, 30. Kentucky, 4, 6, 19, 21, 26, 28. Maine, 5, 19, 23, 29, 30. Maryland, 14, 15, 18, 19, 21, 22, 25, 28, 29. Massachusetts, 4, 5, 6, 7, 14, 15, 18, 19, 22, 23, 29. Michigan, 2, 4, 8, 10, 11, 12, 14, 17, 18, 21, 22, 25, 28. Minnesota, 9, 10, 11, 12, 14. Mississippi, 4, 5, 6, 28. Missouri, 3, 4, 5, 6, 11, 14, 17, 18, 26, 27, 28, 30. Montana, 8, 20, 24. Nebraska, 11, 13, 14, 17, 20. Nevada, 9, 14, 16, 17, 20, 25, 29. New Hampshire, 5, 11, 12, 15, 16, 18, 19, 22, 23, 26, 28, 29. New Jersey, 2, 15, 18, 19, 22, 25, 27, 28, 29. New Mexico, 27, 29. New York, 2, 4, 9, 10, 12, 13, 15, 16, 17, 18, 19, 20, 26, 28, 30. North Carolina, 6, 25. North Dakota, 8. Ohio, 1, 2, 4, 13, 14, 15, 18, 19, 20, 21, 22, 25, 28, 30. Oklahoma, 4, 10, 11, 26, 27. Oregon, 1, 2, 7, 8, 9, 11, 12, 13, 14, 15, 21. Pennsylvania, 4, 12, 15, 18, 19, 22, 23, 25, 26, 28. Rhode Island, 2, 7, 23, 24. South Carolina, 4, 6. South Dakota, 8, 9, 10, 11, 14, 15, 25. Tennessee, 6, 7, 18, 19, 27, 28. Utah, 20, 21, 25, 26. Vermont, 5, 15, 18, 19, 26, 28, 29. Virginia, 7. Washington, 3, 8, 9, 10, 13, 20, 24. West Virginia. 4, 19, 25, 29. Wisconsin, 1, 9, 10, 11, 12, 14, 15, 17, 21, 25, Wyoming, 1, 15, 20, 23, 24.

HUMIDITY.

Average relative humidity and departures from the normal.

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
	%			%	
New England	79	+4	Missouri Valley	77	+5
Middle Atlantic	77	+6	Northern Slope	74	+8
South Atlantic	75	+1	Middle Slope	66	+6
Florida Peninsula	78	0	Southern Slope	46	−10
East Gulf	73	−1	Southern Plateau	28	−12
West Gulf	69	−1	Middle Plateau	58	+4
Ohio Valley and Tennessee	75	+5	Northern Plateau	70	0
Lower Lake	79	+3	North Pacific Coast	76	−4
Upper Lake	82	+4	Middle Pacific Coast	76	0
North Dakota	80	+3	South Pacific Coast	69	−5
Upper Mississippi Valley	77	+6			

WIND.

The maximum wind velocity at each Weather Bureau station for a period of five minutes is given in Table I, which also gives the altitude of Weather Bureau anemometers above ground.

Following are the velocities of 50 miles and over per hour registered during the month:

Maximum wind velocities.

Stations.	Date.	Velocity.	Direction.	Stations.	Date.	Velocity.	Direction.
Amarillo, Tex	14	50	w.	Erie, Pa	15	52	s.
Atlanta, Ga	28	50	w.	Fort Canby, Wash	7	60	se.
Atlantic City, N. J	19	50	nw.	Do	8	60	se.
Block Island, R. I	7	60	ne.	Hannibal, Mo	11	54	sw.
Do	20	50	w.	Hatteras, N. C	7	50	w.
Do	29	50	w.	Do	28	50	w.
Boston, Mass	7	58	ne.	Do	29	57	w.
Buffalo, N. Y	5	66	sw.	Independence, Cal	9	54	nw.
Do	12	50	w.	Knoxville, Tenn	26	50	nw.
Do	15	58	sw.	Mount Tamalpais, Cal.	1	50	w.
Do	23	52	w.	Do	12	63	nw.
Do	29	58	w.	Do	13	76	nw.
Cape May, N. J	29	50	w.	Do	14	62	n.
Carson City, Nev	1	70	w.	Do	16	52	sw.
Do	2	58	w.	Do	22	54	sw.
Charlotte, N. C	5	55	s.	Do	25	71	nw.
Chattanooga, Tenn	4	50	sw.	Do	28	58	nw.
Chicago, Ill	5	50	ne.	Do	29	59	nw.
Do	11	51	sw.	Nantucket, Mass	7	53	e.
Do	12	58	sw.	New York, N. Y	5	53	n.
Cleveland, Ohio	7	52	nw.	Do	7	62	nw.
Do	15	51	w.	Do	8	68	nw.
Do	28	52	w.	Do	16	55	nw.
Columbia, Mo	11	51	sw.	Do	19	75	nw.
Denver, Colo	14	50	w.	Do	20	80	n.
Eastport, Me	7	60	ne.	Do	23	52	w.
Do	29	51	se.	Do	29	72	n.
El Paso, Tex	20	62	w.	Oklahoma, Okla	11	60	nw.
Do	21	50	w.	Pueblo, Colo	14	52	w.
Do	26	50	sw.	Sioux City, Iowa	12	50	nw.
Do	27	60	nw.	Springfield, Mo	11	57	sw.
Do	29	58	sw.				

SUNSHINE AND CLOUDINESS.

The distribution of sunshine is graphically shown on Chart VII, and the numerical values of average daylight cloudiness, both for individual stations and by geographical districts, appear in Table I.

Average cloudiness and departures from the normal.

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
New England	6.6	+1.1	Missouri Valley	6.2	+0.6
Middle Atlantic	6.7	+1.2	Northern Slope	6.1	+0.8
South Atlantic	4.8	+0.1	Middle Slope	5.0	+0.6
Florida Peninsula	3.1	−0.9	Southern Slope	3.1	−1.1
East Gulf	4.5	−0.2	Southern Plateau	2.4	−0.6
West Gulf	5.1	−0.1	Middle Plateau	6.6	+1.7
Ohio Valley and Tennessee	6.9	+1.0	Northern Plateau	6.2	−0.3
Lower Lake	7.8	+1.4	North Pacific Coast	6.7	+0.1
Upper Lake	6.9	+1.0	Middle Pacific Coast	6.5	+1.5
North Dakota	5.4	−0.1	South Pacific Coast	4.4	−0.1
Upper Mississippi Valley	6.7	+1.2			

ATMOSPHERIC ELECTRICITY.

Numerical statistics relative to auroras and thunderstorms are given in Table VII, which shows the number of stations from which meteorological reports were received, and the number of such stations reporting thunderstorms (T) and auroras (A) in each State and on each day of the month, respectively.

Thunderstorms.—Reports of 2,125 thunderstorms were received during the current month as against 1,660 in 1898 and 708 during the preceding month.

The dates on which the number of reports of thunderstorms for the whole country were most numerous were: 4th, 179; 3d and 18th, 169; 5th, 167; 12th, 157.

Reports were most numerous from: Ohio, 172; North Carolina, 166; Tennessee, 156; Kentucky, 139.

Auroras.—The evenings on which bright moonlight must have interfered with observations of faint auroras are assumed to be the four preceding and following the date of full moon, viz, 22d to 31st.

The greatest number of reports were received for the following dates: 6th, 8; 21st, 7; 10th, 4.

Reports were most numerous from: Montana, 10; North Dakota, 8; Ohio, 5.

In Canada.—Auroras were reported as follows: Halifax, 22d; Charlottetown, 15th; Father Point, 6th, 10th; Quebec, 2d, 6th, 9th, 10th, 14th, 21st; Montreal, 17th; White River, 6th, 7th; Port Arthur, 7th; Minnedosa, 3d, 12th, 21st; Banff, 21st; Prince Albert, 10th, 15th; Battleford, 11th, 14th, 16th, 17th.

Thunderstorms were reported as follows: Yarmouth, 5th, 20th; Toronto 8th, 22d; Port Stanley, 15th, 23d.

TABLE I.—*Climatological data for Weather Bureau Stations, March, 1899.*

Stations.	Elevation of instruments. Barometer above sea level, feet.	Thermometers above ground.	Anemometer above ground.	Pressure, in inches. Mean actual, 8 a. m. and 8 p. m. ÷ 2.	Mean reduced.	Departure from normal.	Temperature of the air, in degrees Fahrenheit. Mean max. and min. ÷ 2.	Departure from normal.	Maximum.	Date.	Mean maximum.	Minimum.	Date.	Mean minimum.	Greatest daily range.	Mean wet thermometer.	Mean temperature of the dew-point.	Mean relative humidity, per cent.	Precipitation, in inches. Total.	Departure from normal.	Days with .01, or more.	Wind. Total movement, miles.	Prevailing direction.	Maximum velocity. Miles per hour.	Direction.	Date.	Clear days.	Partly cloudy days.	Cloudy days.	Average cloudiness, tenths.	Total snowfall.
New England.							33.0	0.0										79	6.89	+ 2.9										6.7	
Eastport	76	69	74	29.85	29.94	+ .06	28.4	— 0.3	46	6	34	4	18	23	27	26	22	80	5.48	+ 1.1	20	10,866	w.	60	ne.	7	5	8	18	7.4	23.7
Portland, Me.	103	81	89	29.81	29.92	.00	29.2	— 2.8	48	12	36	10	18	23	21	26	21	74	6.49	+ 3.1	19	6,502	nw.	37	ne.	7	8	7	16	6.5	38.3
Northfield	872	15	65	28.98	29.97	— .01	23.1	— 1.9	46	12	31	— 4	17	15	28	22	19	81	4.03	+ 1.6	20	7,568	s.	42	sw.	1	3	11	17	7.5	28.9
Boston	125	115	181	29.81	29.95	+ .01	34.0	— 0.2	65	12	41	15	17	27	26	31	26	75	5.95	+ 1.8	17	10,360	w.	58	ne.	7	10	6	15	6.1	9.3
Nantucket	14	43	54	29.93	29.94	— .01	36.6	+ 1.7	54	5	42	22	17	32	20	34	32	86	5.66	+ 2.1	20	11,442	nw.	53	e.	7	8	6	17	6.9	3.7
Woods Hole	22	51	57	....	....	....	35.4	+ 0.3	56	5	42	18	17	29	22	....	....	....	8.44	+ 3.8	19	12,813	sw.	49	nw.	8	6	6	19	7.1	4.0
Vineyard Haven	......	20	55	....	....	....	37.8	+ 0.8	58	12	45	19	17	31	25	....	....	....	8.87	+ 4.5	19	8,881	nw.	46	se.	7	8	6	17	6.8	5.7
Block Island	27	11	48	29.92	29.95	.00	35.8	+ 1.0	54	5	41	20	21	30	22	33	28	77	8.54	+ 4.5	17	13,921	nw.	60	ne.	7	10	9	12	5.6	6.6
Narragansett	......	10	....	....	....	....	34.8	+ 1.5	53	5	41	16	17	28	22	....	....	....	8.13	+ 3.5	18	......	e.	....	......	....	15	1	15	....	5.5
New Haven	107	118	140	29.83	29.95	— .03	34.4	— 0.2	54	31	41	17	21	28	20	32	28	77	7.28	+ 3.1	15	8,350	n.	46	nw.	29	7	12	12	6.0	10.1
Mid. Atlan. States.							40.3	+ 0.9										77	5.28	+ 1.3										6.7	
Albany	97	84	113	29.87	29.98	.00	31.2	— 0.7	55	12	38	14	17	25	22	28	24	77	3.97	+ 1.3	16	6,868	n.	40	n.	7	5	7	19	7.4	20.8
Binghamton	875	79	90	....	....	....	31.0	+ 0.2	62	12	37	10	21	25	26	....	....	....	2.84	— 0.3	16	6,599	nw.	33	w.	29	3	6	22	7.9	13.1
New York	314	313	346	29.62	29.96	— .08	38.4	+ 1.5	64	12	45	20	21	32	22	35	30	76	6.78	+ 2.8	16	14,056	nw.	80	n.	20	6	8	17	6.9	9.6
Harrisburg	377	94	104	....	....	....	38.4	+ 2.2	71	12	44	20	21	32	28	....	....	....	3.69	+ 0.2	14	7,491	e.	45	w.	29	5	8	18	7.1	1.5
Philadelphia	117	168	184	29.85	29.97	— .04	40.7	+ 1.6	70	12	48	23	21	34	29	36	31	74	6.47	+ 3.2	14	9,074	nw.	37	nw.	26	4	8	19	7.7	4.4
Atlantic City	52	68	76	29.91	29.97	— .01	38.9	+ 1.3	58	31	45	21	21	33	20	36	34	88	4.17	+ 0.2	12	10,226	sw.	50	nw.	19	4	13	14	6.8	1.8
Cape May	24	52	70	29.97	29.99	....	37.6	— 1.9	62	31	45	23	21	34	19	36	....	....	3.45	— 1.5	11	12,007	nw.	50	w.	29	7	8	16	6.5	4.2
Baltimore	123	68	82	29.83	29.96	— .05	41.7	+ 0.2	74	12	49	26	21	35	30	37	32	74	4.93	+ 0.8	12	5,040	e.	30	w.	29	7	10	14	6.5	1.6
Washington	112	59	76	29.86	29.99	— .08	42.2	+ 0.9	72	12	50	13	7	34	30	37	33	74	4.94	+ 0.8	12	7,328	nw.	46	w.	19	7	9	15	6.6	4.5
Cape Henry	......	5	34	....	....	....	48.0	+ 2.8	75	12	57	20	7	39	34	....	....	....	6.97	+ 1.8	17	10,873	sw.	42	nw.	23	9	7	15	6.1	1.0
Lynchburg	685	83	88	29.22	29.97	— .06	46.2	+ 1.0	72	31	55	14	7	37	36	41	35	71	9.01	+ 5.3	16	4,376	nw.	37	nw.	19	8	14	9	5.9	1.0
Norfolk	92	102	111	29.90	30.00	— .02	49.1	+ 2.2	74	12	59	17	7	39	35	44	41	80	6.12	+ 1.5	14	9,270	s.	48	sw.	7	12	9	10	4.9	0.1
Richmond	144	98	105	....	....	....	47.5	......	75	31	57	19	7	38	39	....	....	....	5.56	......	13	6,146	se.	38	e.	12	3	8	20	7.3	5.0
S. Atlantic States.							56.0	+ 2.3										75	3.10	— 1.4										4.8	
Charlotte	773	68	76	29.16	30.00	— .02	50.6	+ 0.7	76	4	61	14	7	40	33	45	40	71	5.49	+ 0.8	15	7,137	s.	55	s.	5	13	7	11	4.7	T.
Hatteras	11	17	36	30.01	30.02	+ .01	52.8	+ 2.7	68	*	58	29	7	47	22	50	48	83	2.18	— 3.9	12	11,474	s.	57	w.	29	13	10	8	4.5	T.
Kittyhawk	9	12	30	....	....	....	49.8	+ 2.4	72	12	58	24	8	41	28	....	....	....	3.85	— 1.3	12	11,842	......	....	......	....	14	6	11	5.2	
Raleigh	375	93	101	29.61	30.02	.00	51.5	+ 3.3	75	4	62	19	7	41	32	47	44	83	6.33	+ 1.4	16	5,991	sw.	30	sw.	5	13	7	11	4.8	
Wilmington	78	82	90	29.95	30.04	+ .02	56.0	+ 2.1	78	4	65	25	8	47	28	50	45	76	1.01	— 2.9	12	8,418	sw.	45	w.	28	9	17	5	4.9	T.
Charleston	48	14	92	30.02	30.07	+ .08	60.0	+ 3.3	80	23	68	26	7	52	24	52	48	72	1.60	— 2.3	8	8,980	sw.	38	w.	6	7	22	2	4.4	T.
Columbia	......	5	....	....	....	....	56.0	+ 1.8	84	28	68	20	7	44	35	....	....	....	3.57	— 1.0	11	......	sw.	....	......	....	9	10	12	5.5	T.
Augusta	180	89	103	29.83	30.02	— .01	57.2	+ 1.7	81	3	68	14	7	46	38	50	45	68	3.18	— 2.0	11	6,366	sw.	40	w.	28	13	6	12	5.2	T.
Savannah	82	63	89	29.96	30.05	— .02	61.0	+ 2.5	85	26	71	24	8	51	31	53	49	75	2.53	— 1.2	9	7,793	sw.	40	nw.	7	9	18	4	4.4	
Jacksonville	43	69	84	30.02	30.07	+ .02	64.6	+ 2.6	86	27	75	26	8	54	32	57	53	75	1.35	— 2.1	5	6,187	s.	38	sw.	28	11	19	1	4.0	
Florida Peninsula.							70.1	+ 1.4										78	1.71	— 0.4										3.1	
Jupiter	28	13	30	30.03	30.06	+ .01	70.4	+ 2.6	88	26	78	43	8	63	24	65	62	79	3.58	+ 1.4	5	7,634	se.	35	sw.	5	20	10	1	3.3	
Key West	22	43	50	30.05	30.07	+ .02	73.0	+ 0.3	82	27	77	52	8	69	14	68	65	80	0.14	— 1.0	3	7,142	se.	36	n.	7	22	7	2	2.8	
Tampa	36	60	67	30.02	30.06	.00	66.8	+ 1.3	83	13	76	34	8	58	28	60	56	76	1.40	— 1.6	4	5,493	sw.	28	w.	6	18	9	4	3.3	
East Gulf States.							59.8	+ 1.5										73	4.34	— 1.6										4.5	
Atlanta	1,131	92	126	28.83	30.04	— .03	58.3	+ 1.8	78	3	63	8	7	44	36	46	40	68	5.38	— 0.7	13	8,427	nw.	50	w.	28	9	10	12	5.4	0.5
Pensacola	56	78	90	29.98	30.04	— .02	61.6	+ 2.1	81	31	68	32	8	56	27	56	52	76	6.42	+ 1.0	12	7,681	sw.	35	nw.	6	11	12	8	4.7	
Mobile	57	88	96	29.97	30.03	— .02	60.2	+ 1.3	77	18	68	32	8	52	33	56	54	85	7.56	0.0	10	7,707	s.	32	sw.	4	21	6	4	3.2	
Montgomery	221	100	112	29.77	30.01	— .05	59.4	+ 2.4	87	27	70	22	7	49	39	52	47	71	2.20	— 4.3	11	7,066	s.	43	w.	4	14	12	5	4.3	T.
Meridian	375	84	94	....	....	....	58.0	+ 0.6	85	27	69	25	7	47	38	....	....	....	4.10	— 2.2	12	6,686	s.	36	w.	18	11	12	8	4.9	
Vicksburg	247	65	73	29.69	29.96	— .09	59.0	+ 1.0	83	26	69	30	6	49	31	53	50	59	4.93	— 1.5	10	8,140	se.	42	w.	18	12	10	9	4.7	
New Orleans	54	112	120	29.96	30.02	— .01	64.4	+ 2.4	84	26	73	38	6	56	27	59	56	79	2.71	— 2.6	10	8,738	s.	37	nw.	6	12	14	5	4.1	
Port Eads	......	27	....	....	....	....	62.5	+ 0.3	78	*	70	39	*	55	22	....	....	....	1.39	— 2.4	6	......	se.	....	......	....	19	3	9	....	
West Gulf States.							59.4	+ 1.6										69	1.36	— 2.0										5.1	
Shreveport	249	77	84	29.69	29.95	— .08	58.6	+ 1.0	83	22	70	27	6	47	35	50	42	63	2.99	— 1.6	6	7,702	se.	37	s.	11	8	9	14	6.0	
Fort Smith	481	63	72	29.41	29.94	— .07	50.5	+ 0.5	78	9	62	20	6	38	39	42	35	63	1.48	— 1.8	5	7,488	e.	44	w.	11	9	9	13	5.9	0.1
Little Rock	357	93	100	29.59	29.98	— .07	51.0	— 1.2	79	3	61	18	7	41	38	45	39	69	2.79	— 2.4	9	7,787	nw.	36	nw.	5	9	13	9	5.5	
Corpus Christi	20	42	50	29.90	29.92	— .09	66.7	+ 3.9	87	22	73	42	*	61	21	62	59	82	0.29	— 1.4	5	11,364	se.	37	se.	10	12	10	9	4.5	
Fort Worth	670	106	114	....	....	....	55.4	......	97	25	69	25	*	41	50	....	....	....	0.32	......	3	10,643	sw.	38	s.	29	19	8	4	3.5	
Galveston	54	85	96	29.89	29.94	— .07	62.7	+ 0.2	78	18	68	39	6	58	20	58	56	83	0.53	— 2.4	10	8,196	se.	33	nw.	18	7	7	17	6.6	
Palestine	510	54	61	29.39	29.94	— .09	60.4	+ 2.8	88	25	72	26	6	49	35	52	45	64	1.43	— 2.6	7	8,076	s.	29	sw.	9	10	13	8	5.0	
San Antonio	704	95	104	29.18	29.92	— .09	65.6	+ 3.7	97	25	78	32	6	53	43	54	44	56	T.	— 2.0	0	8,647	se.	39	n.	18	16	6	9	4.1	
Ohio Val. & Tenn.							43.8	— 0.2										75	6.85	+ 2.5										6.9	
Chattanooga	762	106	112	29.20	30.03	— .02	50.4	— 0.1	79	3	61	2	7	40	33	45	40	72	14.05	+ 8.0	18	6,821	se.	50	sw.	4	4	16	11	6.2	1.3
Knoxville	1,004	10	88	28.93	30.02	— .05	48.4	+ 0.8	76	4	59	5	7	38	39	43	38	73	11.28	+ 5.9	17	7,693	sw.	50	nw.	26	11	10	10	5.1	0.1
Memphis	399	140	154	29.55	29.99	— .05	51.0	— 0.6	80	3	60	15	7	42	38	44	39	68	3.03	— 2.8	15	9,881	s.	46	sw.	11	6	10	15	6.6	0.5
Nashville	545	128	134	29.42	30.01	— .03	47.6	— 1.1	78	3	58	3	7	37	32	43	38	74	7.81	+ 2.6	14	7,114	s.	44	s.	11	5	6	20	7.1	3.6
Lexington	990	75	102	....	....	....	42.2	+ 0.3	70	11	52	1	7	33	28	....	....	....	8.61	+ 3.7	19	10,801	s.	44	w.	5	5	8	18	7.0	2.0
Louisville	525	114	136	29.39	29.98	— .07	43.2	— 1.2	73	11	52	3	7	34	30	39	35	76	7.02	+ 3.0	19	8,541	sw.	40	s.	18	2	11	18	7.5	0.6
Evansville	434	72	82	....	....	....	42.0	......	69	11	50	4	7	34	29	....	....	....	6.57	......	18	7,223	se.	34	w.	15	9	10	12	5.8	1.5
Indianapolis	823	154	164	29.06	29.97	— .06	36.6	— 2.9	70	11	45	0	7	28	28	33	29	76	4.18	+ 0.6	17	9,766	nw.	46	w.	15	1	13	17	7.5	6.5
Cincinnati	628	152	157	29.28	29.98	— .06	41.0	— 1.2	70	11	50	5	7	32	28	36	32	74	5.94	+ 2.6	19	7,910	nw.	38	w.	15	5	12	14	6.7	2.4
Columbus	824	87	100	29.05	29.96	— .06	38.3	+ 0.2	70	11	48	9	7	29	37	35	32	83	4.69	+ 1.7	19	7,793	w.	38	sw.	15	2	13	16	7.1	3.7
Pittsburg	842	116	123	29.02	29.95	— .08	40.2	+ 1.5	71	11	49	13	7	31	31	36	32	77	3.37	+ 0.6	16	5,165	nw.	33	nw.	15	2	9	20	7.9	5.2
Parkersburg	638	77	84	29.28	29.99	— .04	43.0	+ 2.5	73	11	53	10	7	33	34	38	35	80	5.39	+ 2.1	17	6,663	nw.	42	nw.	15	5	9	17	7.1	4.2
Elkins	1,940	41	51	....	....	....	40.7	......	71	11	52	5	7	30	38	....	....	....	5.12	......	17	6,155	w.	35	w.	19	1	13	17	7.6	5.7
Lower Lake Region.							31.6	— 0.7										79	3.81	+ 1.2										7.8	
Buffalo	768	178	206	29.07	29.94	— .05	31.8	+ 1.8	61	12	38	14	20	25	30	28	24	76	3.03	+ 0.5	16	12,567	w.	66	sw.	5	2	11	18	7.6	11.2
Oswego	335	76	87	29.56	29.95	— .05	29.6	— 0.8	60	12	35	12	17	24	27	27	23	76	4.56	+ 1.9	19	11,411	se.	44	sw.	5	4	7	20	7.6	13.5
Rochester	523	81	90	29.35	29.94	— .05	31.8	+ 1.5	63	11	39	14	20	24	29	28	24	76	3.47	+ 0.6	25	8,013	w.	42	w.	29	6	11	14	6.8	21.2
Erie	714	92	102	29.15	29.95	— .05	32.4	0.0	68	11	39	12	21	26	27	29	27	84	3.08	+ 0.3	17	10,415	w.	52	s.	15	0	10	21	7.6	12.1
Cleveland	762	190	201	29.09	29.95	— .08	33.1	— 0.4	67	11	40	13	8	26	29	30	26	77	3.64	+ 0.9	18	13,194	w.	52	w.	28	1	11	19	7.8	16.4
Sandusky	629	62	74	29.25	29.96	— .07	33.0	— 1.7	68	11	40	9	8	26	33	30	26	78	4.38	+ 1.8	17	7,923	nw.	40	nw.	7	1	2	28	8.8	10.6
Toledo	628	123	127	29.25	29.96	— .05	31.8	— 2.8	66	11	38	10	7	25	31	29	25	80	3.93	+ 1.9	19	9,077	w.	38	s.	12	2	9	20	8.1	17.0
Detroit	730	160	166	29.14	29.97	— .04	29.3	— 3.2	58	11	35	11	7	24	29	27	24	83	4.36	+ 2.1	18	8,553	w.	40	w.	15	2	11	18	8.0	24.1
Upper Lake Region.							21.5	— 5.0										82	2.18	+ 0.1										6.9	
Alpena	609	61	65	29.28	29.98	— .04	20.6	— 3.4	49	11	28	0	1	13	28	20	17	83	2.39	+ 0.4	15	8,355	nw.	36	nw.	15	7	13	11	5.9	15.3
Escanaba	612	43	57	29.32	30.03	+ .01	17.0	— 4.8	35	30	27	— 7	17	7	31	15	12	85	2.22	+ 0.4	8	6,785	ne.	28	nw.	20	8	8	15	6.2	14.8
Grand Haven	628	55	64	29.24	29.96	— .05	27.2	— 3.4	60	11	33	1	7	21	29	25	23	87	2.19	— 0.1	12	8,358	nw.	34	sw.	12	2	10	19	7.8	13.2
Marquette	734	67	95	29.17	30.02	— .02	15.8	— 7.4	35	2	22	— 5	17	9	27	15	13	88	2.79	+ 1.0	11	6,703	n.	32	se.	8	5	13	13	6.8	29.0
Port Huron	639	70	108	29.24	29.97	— .04	28.4	— 0.7	56	11	35	6	8	22	26	26	24	88	2.93	+ 0.3	16	10,162	nw.	43	n.	5	2	14	15	7.5	20.3
Sault Ste. Marie	624	58	65	29.27	29.99	— .05	15.0	— 6.9	33	11	25	—13	1	5	36	13	10	84	1.44	+ 0.2	10	8,451	w.	44	nw.	23	7	8	16	6.4	11.4
Chicago	824	241	274	29.06	29.99	— .04	29.8	— 4.3	64	11	36	3	7	23	27	27	24	81	2.11	— 0.3	10	13,696	nw.	58	sw.	12	6	8	17	7.4	7.4
Milwaukee	671	106	149	29.24	30.00	— .02	25.8	— 4.7	60	11	32	1	6	20	31	23	19	77	1.99	— 0.5	8	8,531	nw.	36	sw.	12	3	5	23	8.4	18.6
Green Bay	617	49	57	29.30	30.02	— .02	20.6	— 6.1	39	9	29	— 2	6	13	32	18	14	78	2.93	+ 0.8	10	6,473	n.	30	n.	12	5	13	13	6.8	17.2
Duluth	702	95	106	29.26	30.08	+ .03	15.2	— 8.8	34	2	23	—10	6	7	27	12	5	66	0.82	— 0.8	7	8,577	ne.	36	ne.	11	9	14	8	5.8	10.1
North Dakota.							8.5	—13.6										80	1.02	+ 0.2										5.4	
Moorhead	935	54	60	29.04	30.14	+ .04	11.1	— 9.1	52	8	21	—16	6	1	34	10	8	90	1.38	+ 0.5	9	8,554	nw.	40	se.	7	8	7	16	6.3	13.0
Bismarck	1,674	16	29	28.26	30.19	+ .09	7.5	—15.1	50	8	18	—19	6	— 3	40	5	— 1	69	0.88	— 0.2	8	7,839	nw.	34	nw.	25	13	8	10	5.5	8.6
Williston	1,872	15	31	28.03	30.19	+ .11	6.8	—16.7	46	7	18	—26	22	— 4	42	5	2	81	0.79	+ 0.3	7	6,787	n.	40	nw.	25	16	12	3	4.4	7.9
Upper Miss. Valley.							29.5	— 6.4										77	2.51	+ 0.2										6.7	
Minneapolis	......	90	208	....	....	....	17.1	—10.8	37	9	25	—12	6	9	24	....	....	....	2.40	+ 0.9	9	9,496	nw.	37	ne.	12	9	9	13	....	23.6

TABLE I.—*Climatological data for Weather Bureau Stations, March, 1899*—Continued.

Stations.	Elevation of instruments: Barometer above sea level, feet.	Thermometers above ground.	Anemometer above ground.	Pressure, in inches: Mean actual, 8 a. m. and 8 p. m. ÷ 2.	Mean reduced.	Departure from normal.	Temperature of the air, in degrees Fahrenheit: Mean max. and min. ÷ 2.	Departure from normal.	Maximum.	Date.	Mean maximum.	Minimum.	Date.	Mean minimum.	Greatest daily range.	Mean wet thermometer.	Mean temperature of the dew-point.	Mean relative humidity, per cent.	Precipitation, in inches: Total.	Departure from normal.	Days with .01, or more.	Wind: Total movement, miles.	Prevailing direction.	Maximum velocity: Miles per hour.	Direction.	Date.	Clear days.	Partly cloudy days.	Cloudy days.	Average cloudiness, tenths.	Total snowfall.
Up. Miss. Val.—Con.																															
St. Paul	837	114	124	29.09	30.06	.00	17.4	-10.1	35	9	25	-11	6	10	24	15	11	76	2.87	+1.4	9	6,479	nw.	28	nw.	19	13	5	13	5.5	26.3
La Crosse	720	70	78	......	......	......	21.2	-9.6	43	11	29	-9	7	14	30	....	....	....	2.02	+0.4	11	5,370	n.	30	nw.	12	8	15	8	5.7	17.8
Davenport	606	71	79	29.30	29.99	-.06	29.0	-5.9	64	10	36	-2	7	22	30	26	22	77	1.94	-0.2	10	7,556	nw.	37	sw.	12	2	4	25	8.3	5.7
Des Moines	867	84	88	29.06	30.05	.00	27.8	-6.9	65	10	36	-1	6	20	36	25	21	80	1.04	-0.4	8	7,281	n.	35	nw.	12	1	21	9	6.4	2.8
Dubuque	698	101	109	29.21	30.01	-.02	25.8	-7.1	56	10	33	-4	7	19	27	24	20	80	1.52	-0.8	9	7,419	nw.	32	nw.	31	7	11	13	6.3	6.1
Keokuk	614	64	78	29.31	30.00	-.03	32.7	-4.9	70	10	40	0	7	25	31	28	24	77	2.66	+0.5	12	7,597	nw.	48	w.	11	5	11	15	6.6	11.3
Cairo	359	87	93	29.58	29.98	-.04	44.4	-2.4	73	25	54	6	7	35	27	39	35	74	3.59	-0.2	15	9,057	n.	40	w.	11	3	14	14	6.8	1.2
Springfield, Ill	644	82	92	29.26	29.98	-.06	34.0	-5.2	64	10	41	2	7	27	25	30	26	75	2.95	+0.2	15	9,381	nw.	41	w.	11	3	7	21	8.0	5.8
Hannibal	534	75	107	......	......	......	35.4	-4.1	70	10	44	3	7	27	39	....	....	....	2.66	+0.3	13	8,947	n.	54	sw	11	7	10	14	6.6	10.0
St. Louis	567	111	210	29.34	29.98	-.06	39.6	-3.5	69	10	49	3	7	30	31	35	31	78	3.96	+0.5	14	9,471	nw.	60	sw.	11	6	12	13	6.4	10.3
Missouri Valley.							27.6	-8.3										77	1.67	-0.1										6.2	
Columbia	783	4	84	......	......	......	37.2	-4.1	72	10	48	0	7	26	40	....	....	....	2.71	-0.3	10	8,742	nw.	51	sw.	11	2	14	15	7.1	7.0
Kansas City	963	78	95	28.93	30.01	-.04	35.0	-5.5	69	10	44	6	6	26	39	31	28	79	2.95	+0.8	12	7,838	nw.	33	sw.	14	6	9	16	6.6	4.9
Springfield, Mo	1,324	100	103	28.52	29.97	-.06	40.2	-3.3	72	9	50	3	7	30	36	35	31	76	1.87	-1.5	10	10,972	se.	57	sw.	11	9	13	9	5.5	4.8
Topeka	......	81	......	......	......	......	34.6	-6.4	71	10	44	5	6	25	43	....	....	....	3.14	+1.1	12	....	n.	....	......	...	4	19	8	6.2	14.1
Lincoln	1,199	74	84	28.70	30.05	-.01	27.8	-10.1	69	10	37	2	6	19	41	24	19	75	0.70	-0.6	6	10,445	n.	45	n.	5	7	13	11	6.1	6.2
Omaha	1,103	92	97	28.81	30.05	-.01	26.8	-8.7	68	10	35	-2	6	19	38	24	20	78	0.64	-0.9	10	7,536	nw.	30	nw.	12	3	12	16	7.0	5.4
Sioux City	1,139	96	164	......	......	......	22.0	-9.6	53	8	29	-6	6	14	36	....	....	....	0.55	-0.8	7	10,892	nw.	50	nw.	12	8	10	13	6.0	4.7
Pierre	1,572	50	62	28.34	30.13	+.04	15.4	-14.0	60	8	24	-9	23	7	38	14	9	75	2.06	+1.2	14	9,374	nw.	43	nw.	25	7	12	12	6.2	18.3
Huron	1,306	56	67	28.61	30.12	+.02	16.0	-11.6	64	8	26	-15	23	6	42	13	10	81	1.13	+0.2	10	9,791	nw.	46	se.	7	11	14	6	5.1	9.9
Yankton	1,234	52	58	......	......	......	20.7	-9.3	61	8	29	-5	6	12	34	....	....	....	0.91	-0.2	11	7,399	nw.	38	nw.	5	5	16	10	6.3	11.1
Northern Slope.							21.3	-10.6										74	1.31	+0.5										6.1	
Havre	2,494	46	47	27.34	30.16	+.11	8.6	-20.4	49	7	19	-25	3	-2	36	8	6	90	0.73	+0.2	14	7,129	ne.	40	e.	19	15	9	7	4.8	7.8
Miles City	2,372	41	49	27.46	30.12	+.04	16.0	-15.4	50	7	26	-16	5	6	40	14	12	88	1.85	+1.3	11	5,377	w.	30	sw.	25	6	18	7	5.6	18.4
Helena	4,108	88	93	25.73	30.13	+.07	22.6	-10.0	55	7	32	-7	21	13	35	19	12	66	1.27	+0.7	12	4,867	sw.	44	sw.	1	3	13	15	6.5	20.9
Rapid City	3,251	46	50	26.52	30.08	+.01	20.7	-10.5	67	24	32	-6	31	9	44	17	14	81	0.94	-0.2	13	6,276	nw.	36	nw.	10	6	10	15	6.8	9.4
Cheyenne	6,084	58	60	23.81	30.09	+.03	26.6	-6.2	60	8	38	-16	27	15	37	22	13	59	1.89	+1.2	9	9,674	nw.	43	nw.	14	3	12	16	6.8	18.9
Lander	5,372	28	36	24.46	30.03	-.04	26.8	-4.1	64	7	40	-11	5	14	45	22	13	60	1.65	+0.3	8	3,670	sw.	32	n.	8	8	13	10	5.9	16.5
North Platte	2,826	43	52	26.99	30.07	.00	27.6	-7.5	75	8	40	-2	27	15	49	23	18	73	0.83	+0.1	5	8,383	nw.	43	nw.	14	10	9	12	6.0	7.8
Middle Slope.							38.0	-4.3										66	1.28	-0.3										5.0	
Denver	5,290	79	151	24.56	30.05	+.01	33.2	-5.6	69	8	46	-5	27	21	43	26	16	57	1.10	+0.1	10	6,692	ne.	50	w.	14	14	10	7	5.0	20.4
Pueblo	4,682	74	81	25.12	29.94	-.08	37.6	-2.8	75	24	53	-6	28	22	47	30	18	52	1.09	+0.6	7	6,951	nw.	52	w.	14	12	14	5	4.7	7.2
Concordia	1,398	42	47	28.48	30.03	-.02	32.8	-6.2	74	10	43	7	6	23	43	28	25	78	1.57	-0.2	7	6,646	n.	30	nw.	14	7	17	7	5.7	13.6
Dodge	2,504	44	52	27.29	29.99	-.02	39.0	-2.6	86	8	54	2	28	24	53	30	24	66	0.47	-0.5	5	9,484	se.	48	nw.	14	8	16	7	5.3	4.4
Wichita	1,351	78	85	28.51	29.99	-.03	39.1	-4.4	76	9	50	11	28	28	45	33	28	72	2.53	+0.6	6	8,918	n.	42	sw.	14	7	14	10	5.5	9.7
Oklahoma	1,218	54	62	28.62	29.94	-.08	46.5	-4.0	81	20	60	16	6	33	42	40	34	69	0.90	-2.2	4	11,306	n.	60	nw.	11	16	11	4	3.5	0.1
Southern Slope.							51.5	+2.0										46	0.10	-0.7										3.1	
Abilene	1,749	45	54	28.08	29.93	-.09	58.0	+3.9	93	25	72	23	28	44	41	44	30	44	0.04	-1.1	1	10,082	sw.	44	sw.	29	13	15	3	4.0	
Amarillo	3,691	54	61	26.11	29.94	-.07	45.0	+0.1	82	24	61	7	28	29	49	34	21	49	0.17	-0.3	3	13,897	n.	50	w.	14	20	10	1	2.2	1.7
Southern Plateau.							54.3	+0.1										28	0.12	-0.4										2.4	
El Paso	3,767	10	110	26.08	29.90	-.05	57.6	+1.8	86	24	73	28	12	42	49	40	6	19	0.23	-0.2	1	11,737	nw.	62	w.	20	24	6	1	1.7	
Santa Fe	6,998	47	50	23.11	29.94	-.05	40.4	+0.9	68	24	52	18	28	29	30	30	9	35	0.35	-0.3	2	5,961	nw.	32	nw.	3	22	6	3	2.8	1.0
Flagstaff	6,885	12	25	23.23	30.05	......	35.4	......	63	7	48	6	14	22	42	31	....	....	0.87	......	10	....	sw.	....	......	...	12	8	11	4.2	6.9
Phenix	1,076	47	57	28.77	29.91	-.04	60.0	-1.5	86	7	74	33	11	46	40	45	27	32	T.	-0.7	0	3,723	e.	23	sw.	13	23	4	4	2.4	
Yuma	139	16	50	29.75	29.90	-.06	63.2	-1.3	89	7	78	34	11	48	39	48	30	34	T.	-0.3	0	6,739	w.	42	w.	9	26	5	0	0.9	
Independence	3,907	10	58	25.88	29.88	-.11	50.5	+0.8	75	7	62	26	17	39	35	37	10	23	0.01	-0.5	1	8,815	nw.	54	nw.	9	18	13	0	2.6	0.1
Middle Plateau.							39.5	-1.9										58	2.54	+1.1										6.6	
Carson City	4,720	82	92	25.18	30.02	-.02	40.2	-1.9	71	6	51	12	13	30	45	34	23	55	1.67	+0.3	8	8,549	sw.	70	w.	1	6	8	17	7.0	3.0
Winnemucca	4,340	59	70	25.54	30.00	-.04	37.8	-2.9	67	6	48	14	13	28	41	34	30	77	3.04	+2.2	16	8,582	sw.	45	sw.	7	6	7	18	7.2	16.0
Salt Lake City	4,344	83	90	25.51	30.00	-.08	40.6	-1.0	67	7	49	20	14	32	30	34	24	56	2.93	+0.9	16	5,044	se.	32	s.	17	3	13	15	6.7	11.2
Grand Junction	4,608	43	50	25.24	29.96	......	43.0	......	73	24	55	18	4	31	43	33	18	43	0.59	......	9	5,193	nw.	32	nw.	26	7	14	10	5.7	3.0
Northern Plateau.							37.9	-1.3										70	1.44	-0.4										6.2	
Baker City	3,470	49	55	26.32	30.00	-.06	34.8	-0.7	52	7	42	14	14	28	23	30	24	65	1.24	-0.6	14	4,190	nw.	35	nw.	24	5	5	21	7.2	5.7
Boise	2,736	61	68	27.08	29.99	-.09	41.0	-2.9	58	24	49	22	14	32	29	35	28	63	1.42	-0.4	15	4,551	w.	25	w.	9	6	11	14	6.5	2.9
Idaho Falls	4,742	10	56	25.22	30.14	+.05	32.6	+1.3	54	24	40	11	27	25	33	30	28	85	1.07	-1.1	15	10,705	s.	47	sw.	21	4	5	22	7.7	6.0
Spokane	1,943	99	107	27.87	29.97	-.05	37.8	-1.9	54	7	46	18	22	30	29	32	24	60	1.21	-0.2	9	5,576	sw.	30	w.	29	12	9	10	5.0	9.1
Walla Walla	1,018	65	73	28.88	29.98	-.07	43.4	-2.1	60	5	52	28	26	35	27	40	35	75	2.25	+0.4	16	5,227	s.	28	sw.	21	12	18	1	4.5	T.
N. Pac. Coast Reg.							42.7	-2.6										76	3.91	-1.8										6.7	
Fort Canby	179	10	34	29.80	30.00	-.03	43.6	-1.8	56	16	48	33	14	39	16	41	38	81	3.08	-3.4	21	8,407	w.	60	se.	7	5	5	21	7.2	T.
Neah	50	7	24	29.90	29.96	-.06	41.0	-3.5	52	16	46	31	21	36	17	39	35	81	5.75	-4.8	21	5,665	w.	38	w.	13	4	2	25	8.1	0.7
Port Crescent	256	15	20	......	......	......	39.3	-2.3	52	6	46	26	25	33	23	....	....	....	2.99	-1.7	15	3,236	w.	20	w.	3	6	18	7	5.8	1.9
Seattle	119	114	121	29.86	29.98	-.05	43.4	-2.0	58	5	50	31	26	37	26	39	33	70	1.80	-1.7	11	5,189	s.	28	se.	6	7	13	11	5.8	1.9
Tacoma	213	113	120	......	......	......	42.5	-1.9	57	17	49	28	14	36	26	....	....	....	3.82	-0.1	13	6,168	sw.	39	e.	14	7	4	20	6.7	T.
Astoria	......	18	......	......	......	......	43.8	-2.3	58	16	50	32	25	38	17	....	....	....	4.21	-2.9	19	....	w.	....	......	...	7	7	17	....	
Portland, Oreg	153	203	213	29.84	30.00	-.04	43.8	-3.4	61	27	51	31	25	37	27	40	34	72	2.30	-3.2	15	6,989	nw.	40	s.	8	5	13	13	6.1	0.4
Roseburg	521	56	67	29.43	30.00	-.06	44.4	-3.3	66	5	52	28	22	37	31	41	37	78	7.31	+3.8	20	2,854	ne.	30	sw.	7	5	9	17	7.2	5.6
Mid. Pac. C'st Reg.							51.2	-1.1										76	6.79	+2.7										6.5	
Eureka	64	60	69	29.98	30.04	-.02	48.0	-0.6	64	6	53	35	10	42	24	45	42	83	8.53	+2.0	20	5,026	se.	35	nw.	26	10	6	15	6.1	
Mount Tamalpais	2,375	11	18	27.53	30.05	......	44.6	......	69	6	50	32	13	40	21	41	36	77	10.38	......	17	16,985	w.	76	nw.	13	7	7	17	6.7	0.4
Red Bluff	334	54	58	29.65	30.01	-.02	52.2	-2.3	75	6	61	36	10	44	33	46	40	69	6.22	+3.0	16	6,050	se.	36	se.	15	8	12	11	5.9	
Sacramento	71	106	117	29.95	30.03	-.01	52.8	-1.9	76	6	61	37	9	45	30	47	40	66	6.02	+3.1	11	8,412	se.	40	se.	15	7	11	13	6.2	
San Francisco	153	161	167	29.89	30.05	-.01	52.2	-1.4	74	6	57	42	16	47	25	50	48	86	7.61	+4.5	15	7,316	w.	36	w.	12	6	9	16	6.5	
Point Reyes Light	......	12	16	......	......	......	50.8	+0.7	79	6	57	40	17	45	33	....	....	....	5.56	+1.1	18	12,909	nw.	....	......	...	4	7	20	7.5	
S. Pac. Coast Reg.							55.4	-1.2										69	3.30	+1.0										4.4	
Fresno	332	67	70	29.67	30.02	+.01	54.4	-0.1	86	6	64	35	11	44	39	48	40	64	2.90	+1.8	11	4,676	nw.	32	sw.	15	13	6	12	5.1	
Los Angeles	330	74	82	29.66	30.01	-.01	56.6	+0.3	90	6	66	39	12	47	37	50	44	72	1.81	-1.2	5	3,758	w.	24	sw.	13	8	18	5	4.9	
San Diego	87	94	102	29.92	30.02	-.02	56.4	+0.4	86	5	62	44	12	51	31	49	43	67	0.85	-0.7	4	4,886	nw.	27	sw.	16	25	4	2	2.7	
San Luis Obispo	201	10	46	29.86	30.08	+.03	54.0	-1.2	89	6	64	35	18	44	47	48	42	71	7.62	+4.6	10	4,921	n.	26	w.	13	13	5	13	5.1	
West Indies.																															
Basseterre	29	41	54	30.01	30.04	......	75.6	......	82	20	80	65	9	71	14	67	63	66	1.00	......	12	7,380	e.	23	e.	17	1	24	6	6.2	
Bridgetown	30	57	65	29.96	29.99	......	77.0	......	85	22	83	68	19	71	15	71	69	79	1.68	......	14	5,236	ne.	22	e.	13	1	13	17	7.3	
Colon	25	....	....	29.86	29.89	......	80.0	......	87	5	84	68	26	76	17	74	72	82	1.45	....	8	5,765	ne.	20	ne.	7	9	16	6	5.0	
Havana	57	83	91	29.98	30.04	......	73.8	......	87	26	82	56	21	66	24	67	65	81	0.77	......	4	6,882	e.	32	e.	10	20	7	4	3.1	
Kingston	286	38	52	29.69	29.99	......	75.2	......	87	13	84	65	27	67	21	69	67	78	0.91	......	8	5,614	ne.	29	se.	31	7	17	7	5.4	
Port of Spain	40	65	66	29.91	29.95	......	77.6	......	89	30	85	66	24	70	20	71	68	74	0.71	......	12	3,372	e.	18	e.	18	0	20	11	6.7	
Roseau	25	38	46	......	......	......	......	......	....	....	....	....	....	....	....	....	....	....	......	......	....	......	....	....	......	...	....	....	....	....	
San Juan	82	109	117	29.97	30.05	......	74.7	......	82	7	81	66	8	68	15	69	67	76	2.29	0.0	14	5,281	e.	21	e.	12	21	9	1	3.2	
Santiago de Cuba	82	45	51	29.91	29.99	......	76.6	......	89	2	85	65	4	68	23	69	66	73	1.52	......	8	3,784	s.	24	n.	7	20	6	5	3.6	
Santo Domingo	59	82	88	......	......	......	......	......	....	....	....	....	....	....	....	....	....	....	......	......	....	......	....	....	......	...	....	....	....	....	
Willemstad	75	39	46	29.87	29.94	......	77.5	......	84	26	82	67	4	73	13	71	68	76	1.14	......	18	9,234	e.	25	e.	17	7	24	0	4.4	

NOTE.—The data at stations having no departures are not used in computing the district averages. Letters of the alphabet denote number of days missing from the record. * Two or more dates. † Received too late to be considered in departures, etc.

TABLE II.—*Climatological record of voluntary and other cooperating observers, March, 1899.*

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
	°	°	°	Ins.	Ins.
Alabama.					
Alco	87	23	61.0	3.37	
Ashville	83	9	54.0	11.14	T.
Bermuda	86	25	61.0	3.20	
Birmingham	84	12	58.0	6.43	
Bridgeport				14.00	2.0
Citronelle	82	32	62.2	2.52	
Clanton	83	19	56.1	1.79	0.5
Daphne	84	29	61.8	3.18	
Decatur	80	4	52.9	10.80	T.
Demopolis				2.81	
Elba	89	21	59.9	5.15	
Eufaula *a*	87	21	56.3	3.78	
Eufaula *c*				3.76	T.
Evergreen				3.01	
Florence *a*				7.90	T.
Florence *b*	79	7	51.6	8.67	2.2
Fort Deposit	85	23	58.1	3.30	1.0
Gadsden	84	6	53.0	12.87	T.
Goodwater	87	14	56.2	7.26	1.2
Greensboro	86	21	56.0	6.74	T.
Hamilton	81	11	52.3	9.17	0.5
Healing Springs	89	25	58.6	3.40	
Highland Home	85	23	59.0	3.21	0.5
Jasper	76	10	52.1	7.25	0.3
Livingston	84	21	56.1	5.28	
Lock No. 4	80	11	52.0	5.86	T.
Madison Station	79	10	53.4	9.84	T.
Maplegrove	84	7	50.6	15.60	
Marion				4.80	T.
Mount Willing	85	26	61.4	2.97	
Newbern	84	23	57.2	4.79	0.2
Newburg	78	6	50.6	12.86	2.0
Newton	85	20	57.8	7.08	T.
Oneonta	78	4	53.0	9.32	T.
Opelika	84	16	54.2	5.58	T.
Oxanna	81	12	54.2	5.93	0.5
Pineapple	91	22	57.5	4.40	T.
Pushmataha	87[j]	27	56.8[e]	3.89	
Riverton	81[d]	8[d]	48.7[d]	6.91	T.
Rockmills	85	13	56.7		T.
Scottsboro	78	5	49.4	15.56	T.
Selma	86	21	58.2	3.45	T.
Talladega	87	11	55.2	7.35	
Tallassee				4.42	T.
Tuscaloosa	84	17	55.0	7.63	
Union	91			6.36	T.
Union Springs	87	21	57.0	3.80	T.
Uniontown		25		4.49	T.
Valleyhead	80	4	51.3	10.62	1.0
Warrior				10.56	
Wetumpka	87	22	56.7	3.92	
Wilson *[1]	86	26	61.7	3.76	
Wilsonville				7.54	
Arizona.					
Allaire Ranch				0.17	
Aztec *[1]	89	38	63.0	T.	
Benson *[1]	81	32	61.3	0.08	
Bisbee	80	28	53.7	0.40	
Blaisdell *[1]	94	44	65.5	0.00	
Bowie *[1]	82	38	55.1	0.03	
Buckeye	93	28	58.6	0.00	
Casa Grande *[1]	88	40	65.0	0.00	
Champie Camp	90	34	61.4	0.00	
Cochise *[1]	90	30	52.6	0.15	
Congress	78	35	56.4	0.07	
Dragoon				0.22	
Dragoon Summit *[1]	72	30	50.8	0.00	
Dudleyville	87	26	56.2	0.12	
Fort Apache	75	18	44.8	0.17	
Fort Defiance	68	11	37.8	0.25	2.5
Fort Grant	86	17	52.0	0.25	
Fort Huachuca	80	26	53.6	0.40	
Fort Mohave	90[g]	32	61.6[g]	0.11	
Gilabend *[1]	86	36	58.1	0.00	
Holbrook	79	13	44.8	0.03	T.
Hot Springs	83	36	58.8	T.	
Ingleside	89	29	60.2	T.	
Jerome	76	27	50.6	0.00	
Lochiel *[1]	79	26	51.1	0.23	
Maricopa *[1]	91	34	62.0	0.00	
Mesa	86	29	57.5	T.	
Mount Huachuca	78	18	50.4	0.25	
Music Mountain	85	22	53.0	0.06	
Natural Bridge				0.50	
Oracle	76	28	53.8	1.16	
Oro				0.38	
Oro Blanco	86	33	56.4	0.12	
Pantano				0.06	
Parker	94	28	63.2	0.02	
Peoria	86	34	59.3	0.00	
Phenix	91	27	60.3	T.	
Pima	85	24	54.4	0.21	
Pinal Ranch				0.08	
Prescott	73	11	44.3	0.30	3.0
San Carlos	88	10	53.8	0.05	
San Simon *[1]	80	23	51.0	0.15	
Arizona—Cont'd.					
Sentinel *[1]	91	46	66.7	0.00	
Signal	91	25	57.6	0.10	
Snowflake	71	12	42.4	0.01	
Strawberry	69	7	37.6	0.15	1.5
Texas Hill *[1]	90	40	63.4	0.00	
Tombstone	80	28	54.1	0.19	
Tonto				0.02	
Tuba	79	17	50.1	0.20	T.
Tucson	88	26	56.6	0.37	
Vail *[5]	85	38	62.8	0.50	
Walnut Grove				0.00	
White Hills	83	35	57.0	0.01	
Williams	69	9	38.1	0.95	5.5
Winslow	77	16	47.9	T.	T.
Yarnell				0.20	2.0
Arkansas.					
Amity	81	20	52.4	1.93	
Arkansas City				4.28	
Batesville *	85	25	51.2		
Beebranch	78	15	49.6	3.75	
Blanchard Springs	82	23	56.2	5.24	
Brinkley	82	10	52.9	3.75	
Camden *a*				3.42	
Camden *b*	80	21	54.4	3.48	
Canton *[1]	72	13	46.0		
Conway	83	14	52.0	2.73	T.
Corning	76	9	45.0	4.35	0.5
Dallas	78	17	51.0	1.12	T.
Dardanelle				2.14	
Elon	84	24	56.1	5.35	
Fayetteville	78	10	47.2	1.11	1.5
Forrest	81	11	52.4	3.10	
Fulton				1.59	
Hardy	77	10	46.3	2.24	0.2
Helena *a*				4.28	
Helena *b*	82	19	53.5	4.87	
Hot Springs *a*	82	17	52.2	1.87	T.
Hot Springs *b*				2.32	
Jonesboro		1		2.00	
Keesees Ferry	76	9	46.6	1.57	3.2
Lacrosse	72	12	42.4		
Lonoke	80	27	51.5	2.93	T.
Luna Landing *[6]	80	25	55.4	4.33	
Lutherville	77	17	51.6		
Malvern	80	20	54.7	2.84	
Marianna	81	20	52.8	2.64	T.
Marvell	81	18	52.6	4.04	
Moore				3.57	T.
Mossville	75	8	43.9	1.39	T.
Mount Nebo	77	11	48.2	2.39	T.
New Gascony	82	19	52.8	3.13	T.
Newport *a*				4.78	
Newport *b*	81	14	49.6	3.44	
Newport *c*	80	14	50.1	3.62	
Oregon	76	8	46.5	0.82	T.
Osceola	78	13	44.9	8.40	3.0
Ozark	82	12	50.2	1.63	T.
Picayune	86	20	56.7	2.20	
Pinebluff	84	21	54.1	3.08	
Pocahontas	74	10	46.8	3.76	0.8
Pond	74	1	46.0	1.17	T.
Powell		12		1.31	T.
Prescott				1.70	
Rison		20		3.05	T.
Russellville	80	19	50.2	2.02	0.2
Silver Springs	80	8	46.6	1.49	2.0
Spielerville	82	17	50.0	2.79	T.
Stamps	83	28	53.8	4.44	
Stuttgart	84	20	50.2	3.17	
Texarkana		24		1.09	
Warren	83	22	54.9	4.63	
Washington	82	23	54.0	1.79	
Wiggs *[1]	80	20	54.1	2.63	T.
Winslow	75	8	43.5	1.38	5.0
Witts Springs	76	7	45.4	1.56	0.5
California.					
Agnew	80	30	52.8	4.06	
Arlington Heights	88	32	54.5	0.90	
Azusa				2.49	
Ballast Point L. H				1.14	
Bear Valley				23.34	80.0
Berkeley	72	39	52.0	13.19	
Bishop	78	16	48.7	T.	
Blue Lakes City	85	30	55.9	9.87	
Boca *[1]	64	−4	31.4	7.95	40.0
Bodie	53	1	27.8	1.17	9.0
Bowmans Dam *[1]	64	12	34.5	26.31	108.0
Caliente *[1]	80	41	55.6	3.26	
Campbell	75	31	50.2	4.98	
Cape Mendocino L. H.				9.60	
Cedarville	66	16	36.9	2.93	14.5
Centerville *[1]	82	40	56.6	6.09	
Chico *[1]	77	35	53.4	4.21	
Chino				2.26	
Cisco *[1]	48	14	30.0	19.56	90.0
Claremont	83	31	52.3	2.54	
California—Cont'd.					
Corning *[1]	75	36	48.7	3.03	
Coronado	80	50	59.2		
Craftonville	87	34	53.4	1.66	
Crescent City	64	33	47.5	11.62	
Crescent City L. H				11.92	
Cuyamaca	60	18	39.8	7.23	6.0
Delano *[1]	87	39	52.9	1.39	
Delta *[1]	76	28	49.5	11.81	
Drytown	82	32	53.8	11.14	
Dunnigan *[1]	70	39	53.8	4.29	
Durham *[1]	76	30	52.1	4.56	
Edmanton *[1]	65	17	36.6	17.04	56.0
El Cajon	94	30	55.2	1.15	
Elsinore	103	26	55.7	0.96	
Escondido	87	22	52.0	2.11	
Fallbrook *[1]	90	37	54.1	2.23	
Folsom City *[1]	78	36	53.8	7.13	
Fordyce Dam				21.41	124.0
Fort Bragg				8.83	
Fort Ross	77	36	50.7	16.11	
Fort Tejon				2.99	
Georgetown	72	26	43.5	21.39	8.0
Gilroy (near)	86	28	52.2	6.62	
Gilroy Hot Springs				7.61	
Glendora				2.86	
Goshen *[5]	85	29	56.8	2.64	
Grand Island *[6]	76	33	54.4	3.73	
Grass Valley				19.60	
Greenville	64	15	36.2	7.76	12.5
Healdsburg	82	30	52.7	8.25	
Hollister	87	29	51.8	4.01	
Humboldt L. H				11.84	
Hydesville	70	30	50.8	9.25	
Indio *[1]	89	46	66.0	0.00	
Iowa Hill *[1]	72	30	45.4	18.06	4.0
Irvine	96	38	63.2	1.35	
Jackson	72	30	47.4	14.60	
Jolon				4.31	
Keene *[1]	78	29	45.9	4.10	
Kennedy Gold Mine	73	26	46.4	12.54	
King City *[1]	80	32	51.0	2.04	
Kingsburg *[5]	85	40	57.0	3.33	
Kono Tayee	67	35	50.1	5.48	
Lagrange *[5]	82	34	55.1	5.04	
Lakeside				1.44	
Lamesa				1.10	
Laporte *[1]	55	16	34.1	25.26	118.8
Las Fuentes Ranch				3.05	
Lemoncove	90	28	56.0	5.17	
Lemoore *a* *[1]	84	30	53.4	2.16	
Lick Observatory	68	25	39.6	11.11	
Lime Point L. H				8.24	
Lodi	77	30	52.7	6.81	
Los Alamos				3.47	
Los Gatos *b*	76	35	50.7	11.10	
Malakoff Mine	75	23	43.4	18.24	16.0
Mammoth Tank *[1]	90	50	65.2	0.00	
Manzana	74	33	49.4	1.35	T.
Mare Island L. H				5.70	
Merced *[1]	80	33	53.8	2.64	
Mills College				13.62	
Milo				7.51	
Milton (near) *[1]	78	35	52.2	10.88	
Modesto *[1]	87	37	56.2	3.46	
Mohave *[1]	72	38	53.5	0.48	
Mokelumne Hill *[3]		35	46.4	18.27	
Monterey *[1]	80	38	55.2	3.07	
Morena Dam	75	22	47.0	2.58	
Mountain View				4.00	
Mount Frazier				1.95	16.0
Mutah Flat				2.70	
Napa *b*	81	33	52.8	5.98	
Needles	87	40	66.0	T.	
Nevada City	71	24	43.6	15.88	3.5
Newhall *[1]	86	32	56.0	1.98	
North Ontario	88	34	52.6	2.71	
North San Juan *[1]	71	22	48.0	16.02	1.0
Oakland *a*	73	38	52.6	12.16	
Ogilby *[1]	80	45	62.6	0.00	
Oleta *[1]	70	30	46.6	12.43	T.
Orland *[1]	82	40	54.2	4.17	
Palermo	76	30	52.4	5.88	
Paso Robles *b*	81	30	52.3	4.99	
Peachland *[5]	78	31	52.2	10.25	
Piedras Blancas L. H				13.04	
Pigeon Point L. H				5.14	
Pilot Creek				26.20	40.0
Pine Crest	86	39	56.4	4.01	
Placerville	70	27	45.0	14.98	
Point Ano Nuevo L. H				8.94	
Point Arena L. H				7.74	
Point Bonita L. H				9.98	
Point Conception L. H				2.00	
Point Firmin L. H				0.94	
Point Hueneme L. H				2.65	
Point Lobos	70	41	50.6	7.86	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
California—Cont'd.	°	°	°	*Ins.*	*Ins.*
Point Loma L. H.	......	......	......	0.61	
Point Montara L. H.	......	......	......	10.50	
Point Pinos L. H.	......	......	......	5.02	
Point Sur L. H.	......	......	......	8.25	
Pomona (near)	93	31	55.2	2.10	
Poway*2	89	35	53.3	1.16	
Quincy	57	20	40.1	9.02	5.0
Ranch House	88	42	60.2	1.24	
Raymond	82	26	53.0	6.27	
Redding *b*	74	31	51.1	8.86	
Redlands	89	33	54.8	1.50	
Represa	70	32	52.2	7.88	
Rio Vista	77	36	53.4	6.94	
Roe Island L. H.	......	......	......	4.69	
Romie	89	25	52.2	1.82	
Rosewood	73	25	48.2	6.09	
Sacramento *a*	77	36	54.2	5.98	
Salinas*1	75	40	54.1	4.19	
Salton*1	93	45	62.6	0.00	
San Bernardino	87	29	54.3	3.22	
San Jacinto	85	26	52.4	1.63	
San Leandro*1	85	41	56.2	10.85	
San Luis L. H.	......	......	......	6.91	
San Mateo*1	67	42	52.8	9.02	
Santa Barbara *a*	86	41	56.6	2.78	
Santa Barbara L. H.	......	......	......	2.86	
Santa Clara *a*	......	......	......	4.02	
Santa Cruz *b*	86	30	50.6	9.31	
Santa Cruz L. H.	......	......	......	11.08	
Santa Maria	88	30	54.9	4.88	
Santa Monica*1	75	40	55.6	2.30	
Santa Paula	92	39	59.0	2.41	
Santa Rosa*1	74	31	52.8	8.57	
Shasta	77	31	50.8	10.15	
Sierra Madre	82	39	54.8	2.77	
Sneddens Ranch	......	......	......	1.50	
Sonoma	......	......	......	6.85	
S. E. Farallone L. H.	......	......	......	6.17	
Stanford University	74	32	52.3	6.28	
Stockton *a*	76	33	52.6	6.58	
Summerdale	67	14	36.3	18.66	45.0
Susanville	62	17	38.9	3.82	6.0
Tehama*1	77	41	54.8	4.54	
Tejon Ranch	85	40	55.6	1.51	
Templeton*1	75	38	50.8	6.00	
Thermalito	78	33	52.8	6.32	
Trinidad L. H.	......	......	......	7.66	
Truckee*1	50	8	35.1	9.50	54.0
Tulare *b*	......	......	......	2.74	
Tulare *c*	94	26	55.2	2.28	
Ukiah	74	28	48.8	7.53	
Upperlake	80	28	49.6	5.59	
Upper Mattole*1	82	34	51.8	11.25	
Vacaville *a**1	78	41	53.5	10.26	
Ventura	90	38	55.8	1.73	
Visalia*1	80	30	52.2	2.24	
Volcano Springs*1	93	34	64.8	0.00	
Walnut Creek	76	32	54.3	7.22	
West Palmdale	......	......	......	0.97	T.
Westpoint	......	......	......	15.39	
West Saticoy	......	......	......	1.99	
Wheatland	74	30	51.6	5.45	
Williams*1	73	39	52.9	3.38	
Wilmington*1	91	44	61.0	1.33	
Wire Bridge*5	77	30	50.8	13.18	
Yerba Buena L. H.	......	......	......	7.40	
Yreka	66	22	43.2	1.77	
Yuba City*5	75	37	56.2	6.67	
Colorado.					
Alexander Lakes	......	......	......	3.62	54.5
Antlers	63	13	36.7	1.29	......
Arkins	......	......	......	1.25	14.8
Boulder	68	−5	34.1	2.79	31.0
Boxelder	......	......	......	1.42	16.0
Breckenridge	49	−14	20.4	7.94	120.4
Canyon	75	−5	40.0	0.86	10.7
Castlerock	70c	−11	32.3	0.77	8.0
Cedaredge	70	13	40.0	1.67	4.5
Cheyenne Wells	76	6	35.0	0.39	2.9
Clearview*1	52	−8	25.1	1.54	23.5
Collbran	......	......	......	2.18	7.5
Colorado Springs	68	−3	33.7	0.92	12.8
Cope	73	−3	34.0	0.53	4.8
Crook	74	−12	32.1	1.09	15.0
Delta	76	13	43.4	0.91	3.0
Dumont	......	......	......	2.40	36.0
Durango	65	12	38.6	0.91	5.0
Fairview	59	−21	29.4	0.95	14.5
Fort Collins	66	−24	30.2	1.50	19.8
Fort Morgan	73	−16	31.2	0.47	6.8
Fox	......	......	......	0.25	4.1
Garnett	68	4	31.1	0.03	0.5
Georgetown	55	−15	27.9		
Gleneyrie	66	1	33.0	1.40	18.5
Greeley	69	−19	30.8	0.71	12.5
Hamps	68	3	34.0	2.26	20.0
Colorado—Cont'd.	°	°	°	*Ins.*	*Ins.*
Hoehne	77	−8	38.9	0.80	......
Holly	......	......	......	0.16	2.0
Holyoke	......	......	......	1.05	10.5
Holyoke (near)	75g	−1g	33.6g	1.18	10.0
Hugo	......	......	......	0.70	8.5
Husted	70	−8	34.0	1.57	15.0
Lake Moraine	55	−7	23.8	1.14	18.8
Lamar	85	13	42.0	0.57	5.0
Laporte	......	......	......	1.81	26.0
Las Animas	80	3	42.2	0.28	2.0
Leadville (near)*1	47	5	24.4	4.42	67.0
Leroy	71	−9	31.2	1.21	13.8
Longs Peak	54	−22	23.8	3.01	39.8
Loveland	......	......	......	1.35	16.0
Mancos	64	7	36.2	1.94	4.0
Meeker	......	−16	......	2.50	21.8
Minneapolis	82	5	41.0	0.10	2.0
Moraine	50	−25	25.4	2.98	39.5
Pagoda	56	−16	30.9	2.78	31.0
Parachute	67	5	39.1	1.68	......
Perry Park	......	......	......	0.51	7.8
Rangely	66	1	34.6	2.39	19.0
Rockyford	82	2	39.9	0.44	4.0
Ruby	......	......	......	16.59	249.0
Saguache	55	10	31.1	T.	T.
Salida	63	−3	35.0	0.48	5.5
San Luis	65	2	34.2	0.55	6.9
Santa Clara*1	65	2	33.6	2.16	32.5
Seguro	54	−4	24.0	0.67	8.0
Seibert	......	......	......	0.34	4.0
Silverton	......	−10	......	1.58	25.0
Smoky Hill Mine	58	−17	26.2	5.29	55.0
Springfield	......	......	......	0.08	2.0
Strickler Tunnel	......	......	......	1.37	23.5
Trinidad	......	......	......	1.07	14.0
Troutvale	55	−21	18.6	0.69	11.5
T. S. Ranch	68	13	41.0	1.47	12.0
Vilas	......	......	......	0.21	1.0
Wagon Wheel	53	−3	25.4	0.05	1.0
Walden	50	−20	25.4	1.36	18.8
Wallet	......	......	......	0.30	4.0
Westcliffe	60	−4	31.4	0.67	7.5
Wray	78	4	33.8	0.50	5.0
Yuma	......	......	......	1.18	17.0
Connecticut.					
Bridgeport	55	13	35.3	9.64	9.8
Canton	51	10	30.3	6.91	17.5
Colchester	55	16	34.0	6.45	10.0
Falls Village	......	......	......	5.25	16.5
Greenfield Hill	......	......	......	7.09	9.3
Hartford *a*	54	17	33.2	7.40	9.0
Hartford *b*	......	......	......	7.96	13.5
Hawleyville	54	12	33.0	5.70	10.0
Lake Konomoc	......	......	......	9.25	......
Middletown	57	11	34.1	7.91	10.2
New London	51	17	34.4	7.59	4.3
Norwalk	55	10	33.4	6.69	7.5
Pomfret	57	15	31.9	......	9.0
Southington	54	11	33.0	6.66	10.5
South Manchester	......	......	......	7.18	10.0
Storrs	58	13	30.7	......	6.5
Voluntown	57	16	34.7	7.90	......
Wallingford	......	......	......	8.70	......
Waterbury	57	13	32.8	6.75	6.0
West Cornwall	51	11	28.6	5.84	28.8
West Simsbury	......	......	......	6.76	15.0
Winsted*1	48	14	30.2	......	......
Delaware.					
Milford	72	25	44.7	5.47	4.0
Millsboro	72	20	43.4	5.52	......
Newark	70	22	39.5	6.03	2.5
Seaford	72	23	44.6	5.34	5.0
Wyoming	66f	22e	37.9d	4.22	2.0
District of Columbia.					
Distributing Reservoir*5	68	20	42.0	4.10	......
Receiving Reservoir*5	70	20	42.3	4.50	......
West Washington	76	19	42.8	5.10	5.0
Florida.					
Archer	88	27	64.7	0.83	
Bartow	89	35	69.3	1.63	
Boca Raton	84	44	71.2	0.84	
Brooksville	87	32	66.6	1.10	
Clermont	92	32	69.2	0.85	
De Funiak Springs	85	23	60.8	5.89	
Earnestville	91	33	68.6	3.40	
Estero*1	84	40	70.6	......	
Eustis	90	28	67.6	1.18	
Federal Point	88	28	64.1	1.78	
Fort Meade	88	......	......	1.00	
Grasmere	90	30	66.4	0.94	
Haywood	......	......	......	5.13	
Huntington	89	29	65.4	0.99	
Inverness	88	31	66.0	0.82	
Jasper*	84	26	61.6	3.18	
Kissimmee	86	35	68.2	1.68	
Lake Butler	88	27	64.2	1.53	
Florida—Cont'd.	°	°	°	*Ins.*	*Ins.*
Lake City	88	24	64.6	2.05	
Lemon City	87	47	73.0	1.65	
Macclenny	89	25	63.6	1.71	
Manatee	88	36	67.8	0.80	
Merritts Island	88	38	68.5	1.01	
Myers	86	39	69.6	1.23	
New Smyrna	91	30	65.4	3.01	
Ocala	90	28	64.6	1.24	
Orange City	91	28	67.5	1.96	
Orange Park	86	25	63.8	1.66	
Orlando	89	33	68.0	0.96	
Plant City	93	34	68.8	0.88	
St. Andrews	78	26	60.6	1.98	
St. Francis	90	30	65.3	1.27	
St. Francis Barracks	88	26	63.2	2.15	
Sebastian	88	39	68.7	1.25	
Stephensville	......	......	......	0.62	
Switzerland*1	86	27	63.5	1.91	
Tallahassee	86	25	62.0	3.37	
Tarpon Springs	88	31	66.7	1.04	
Wausau	89	25	61.9	7.61	
Georgia.					
Adairsville	80	6	50.6	7.36	0.2
Albany	81	28	58.4	3.21	
Allentown	85	18	60.1	3.13	0.2
Bellville	85	18	60.0	2.36	
Blakely	85	......	......	4.66	
Canton	......	......	......	8.71	3.0
Carlton	......	......	......	4.35	T.
Cartersville	78	9	52.0	7.73	0.8
Cedartown	83f	......	......	......	T.
Clayton	76	8	49.4	10.29	1.0
Columbus	92	24	60.4	2.71	
Covington	80	10	54.8	3.71	T.
Crescent	......	30	......	1.27	
Dahlonega	77	0	49.0	10.07	2.5
Diamond	79	−3	47.5	9.19	8.0
Dublin	......	......	......	2.65	
Elberton	82	14	53.6	4.42	2.0
Fitzgerald	87	22	60.9	2.75	
Fleming	89	27	60.9	1.84	
Franklin	81	16	56.0	5.73	T.
Gillsville	87	6	52.2	8.63	
Greenbush	80	4	49.7	10.22	T.
Harrison	86	18	58.4	2.86	
Hawkinsville	87	16	57.5	2.39	
Hephzibah*6	86	26	60.4	3.00	T.
Jesup	91	20	60.0	2.20	
Lagrange	85	13	55.8	3.57	0.2
Louisville	83	21	57.4	3.30	
Lumpkin	86	21	59.8	3.78	T.
Marietta	81	6	51.2	7.28	1.1
Marshallville	84	20	59.8	2.91	T.
Mauzy	89	22	61.8	3.93	
Millen	85	22	58.8	2.82	T.
Newnan	......	......	......	4.17	
Pelham	86	......	......	3.11	
Piscola	87	24	63.1	2.45	
Point Peter	78	14	49.8	5.00	T.
Poulan	84	21	58.4	2.57	
Putnam	87	21	58.2	2.10	T.
Ramsey	79	10	53.6	10.85	T.
Resaca	......	......	......	10.01	2.5
Reynolds	......	......	......	3.69	0.6
Rome	......	......	......	8.02	T.
Talbotton	86	17	57.6	3.98	T.
Tallapoosa	80	4	51.4	7.69	1.5
Thomasville	87	23	61.6	3.38	
Toccoa	......	......	......	8.94	
Washington	......	......	......	3.78	
Westpoint	......	......	......	8.53	1.0
Idaho.					
American Falls	59	17	36.4	1.92	1.9
Atlanta	58	−6	28.9	3.35	29.2
Blackfoot	59	12	33.8	0.05	0.5
Burnside	52	1	26.8	0.65	6.5
Challis	60	12	36.9	0.50	5.0
Downey	52	7	29.8	0.68	6.0
Gimlet	51	−3	28.2	2.79	18.8
Gray	56	−8	27.4	1.60	16.0
Hagerman	65	20	41.0	1.91	T.
Kootenai	56	8	30.3	1.20	12.0
Lake	42	−14	20.6	2.20	22.0
Lakeview	54	12	35.5	1.73	11.0
Lewiston	61	28	41.2	0.30	
Lost River	52	7	30.1	0.41	4.0
Marysville	49	−10	26.4	1.50	6.9
Minidoka	61	2	33.6	1.90	18.0
Moscow	51	16	34.8	1.61	12.0
Murray	53	9	32.9	3.35	43.0
Oakley	65	17	37.6	1.85	8.0
Ola	56	15	36.8	2.67	14.1
Paris	49	1	27.8	1.18	20.8
Payette	60	25	40.8	0.98	1.8
Pollock	68	20	41.7	......	......
Priest River	......	......	......	1.23	15.2

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Idaho—Cont'd.	°	°	°	*Ins.*	*Ins.*
St. Maries	57	21	37.6	1.71	8.5
Soldier	55	− 4	29.2	1.46	16.5
Swan Valley	52	− 7	31.0	2.06	23.5
Weston	60	8	35.4	1.63	5.5
Illinois.					
Albion	70	0	41.0	4.58	......
Alexander	65	0	35.9	2.05	6.5
Ashton	61	− 3	29.2	2.21	7.6
Astoria	65	0	33.0	2.75	21.0
Atwood *a**[3]	66	0	31.7	3.24	10.0
Aurora *a*	63	0	29.8	2.92	......
Aurora *b*	62	1	29.8	3.23	10.9
Beardstown	......	......	......	1.21	7.0
Bloomington	64	− 1	33.6	4.72	15.0
Bushnell	67	0	33.1	2.92	12.5
Cambridge	64	− 1	30.2	2.81	7.5
Carlinville	68	0	36.9	3.24	9.3
Carlyle	......	......	......	2.68	6.0
Carrollton	62	0	34.6	2.75	6.5
Charleston	66	− 1	35.7	2.75	6.1
Chemung	60	− 2	26.4	1.94	8.8
Chester	......	......	......	2.53	5.0
Cisne	70	0	39.8	2.76	......
Coatsburg	68	− 3	33.4	2.50	15.0
Cobden*[5]	70	0	40.0	4.04	4.5
Danville	......	1	35.3	3.24	3.5
Decatur	66	− 1	35.2	2.58	9.0
Dixon	63	− 2	29.0	1.67	5.5
Dwight	67	0	31.4	1.76	6.0
Effingham	67	− 1	37.6	2.97	5.0
Elgin	63	1	29.2	2.72	12.4
Equality	70	4	43.6	5.35	1.5
Flora	71	− 2	40.1	3.48	5.7
Fort Sheridan	58	4	25.9	2.47	2.3
Friendgrove	......	......	......	4.55	
Galva	64	− 4	29.6	2.70	9.7
Glenwood*[1]	58[e]	4[e]	31.5[e]	1.65	6.0
Grafton	......	......	......	3.73	13.5
Grayville	69	4	42.2	5.47	2.0
Greenville	66	− 2	36.8	3.38	10.5
Griggsville	69	− 2	35.1	3.81	17.5
Halfway	68	3	42.2	5.16	2.0
Halliday	68	3	40.3	3.58	......
Havana	66[e]	3	35.9	3.39	20.5
Henry	66	− 1	31.9	2.26	15.0
Hillsboro	67	− 2	37.0	3.54	12.5
Joliet	63	3	30.7	2.23	11.2
Kankakee	50	4	31.4	2.75	8.5
Kishwaukee	......	− 3	......	1.74	7.7
Knoxville	66	− 3	29.9	3.01	12.1
Lagrange	64	3	30.8	2.06	6.2
Laharpe	58	0	31.0	3.14	7.5
Lanark	61	− 6	27.5	1.31	1.5
Loami	......	......	......	3.32	8.0
McLeansboro	69	2	41.0	4.33	2.5
Martinsville	67	− 4	37.2	4.05	11.0
Martinton	65	1	32.5	2.14	......
Mascoutah	66	1	38.6	2.88	......
Mattoon	67	1	36.2	2.72	10.1
Minonk	63	0	31.6	2.24	9.0
Monmouth	64	− 3	30.7	3.10	11.0
Morgan Park	64	1	30.9	2.34	5.5
Morrisonville	......	2	......	2.96	8.0
Mount Carmel	......	......	......	5.16	5.7
Mount Pulaski	67	1	35.5	2.86	10.5
Mount Vernon	65	0	38.2	2.90	4.5
New Burnside	73	8	42.5	4.91	3.0
Olney	68	1	39.6	3.03	5.9
Oswego	63	1	30.1	2.70	9.1
Ottawa	62	− 2	30.8	3.21	16.0
Palestine	70	− 1	38.6	4.96	4.0
Pana	66	− 3	36.5	3.44	10.0
Paris	67	− 2	34.5	2.73	......
Peoria *a*	......	......	......	3.59	18.2
Peoria *b*	65	0	34.0	2.97	8.5
Philo	66	0	34.4	2.31	7.5
Plumhill	68	2	39.6	2.86	5.5
Rantoul	63	− 1	33.4	3.49	14.0
Raum	71	3	43.2	6.12	4.5
Riley	59	− 1	27.8	1.65	5.0
Robinson	70	− 2	38.4	4.03	4.5
Roundgrove	64	− 4	29.7	1.94	8.0
St. Charles*[1]	62	1	28.9	2.68	9.5
St. John	70	2	42.2	3.34	1.5
Savanna	66	− 4	30.6	1.09	2.0
Scales Mound	55	− 8	25.4	1.49	6.5
Sullivan	67	− 1	36.6	3.21	13.4
Sycamore	60	0	28.2	2.14	5.8
Tilden	67	1	40.2	2.27	3.2
Tiskilwa	61	− 3	29.6	2.83	10.3
Tuscola	68	− 1	34.3	3.29	11.0
Walnut	64	− 1	31.4	1.99	5.8
Wheaton*[3]	...	6	27.9	2.36	16.5
Winchester	66	1	34.3	3.47	9.0
Winnebago	61	− 4	27.8	1.87	8.0

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Indiana.	°	°	°	*Ins.*	*Ins.*
Anderson	69	1	35.8	4.20	8.0
Angola	63	3	30.0	4.17	32.0
Auburn	67[d]	3[d]	31.5[d]	3.02	......
Bloomington	70	0	38.8	4.71	8.0
Bluffton	68	1	34.8	4.96	13.2
Booneville	......	− 1	......	5.89	......
Bright	70	2	39.5	5.89	......
Butlerville	69	2	40.7	5.43	2.5
Cambridge City	69	1	37.6	3.26	2.6
Columbia City*[1]	62	3	31.2	3.47	20.5
Columbus	71	0	40.4	3.89	4.8
Connersville	70	2	37.4	3.61	5.2
Crawfordsville	71	− 1	32.3	7.83	25.8
Delphi	69	− 1	33.0	4.15	23.8
Edwardsville*[1]	68	3	42.9	7.35	0.3
Farmland	67	3	36.9	5.02	6.2
Fort Wayne	67	2	33.8	5.01	27.0
Franklin*[1]	70	4	38.8	3.78	5.0
Greensburg	70	0	38.3	3.92	3.0
Hammond	65	4	33.0	1.09	1.3
Hector	66	1	35.3	4.16	6.0
Huntington	67	4	33.0	5.05	28.0
Jeffersonville	70	3	43.2	6.66	T.
Knightstown	69	0	36.8	4.74	5.0
Kokomo	68	1	35.2	4.33	14.2
Lafayette	67	− 2	33.8	2.85	10.7
Laporte	......	8	......	3.37	19.7
Logansport *b*	68	1	33.5	3.43	18.0
Madison	70	3	41.6	5.56	2.0
Marengo	71	2	42.4	......	......
Marion	74	− 1	34.9	4.90	19.0
Markle	66	4	34.1	5.30	23.0
Mauzy	70	− 1	37.7	3.78	5.0
Mount Vernon	71	0	41.3	6.87	1.0
Northfield	69	− 1	34.6	3.59	6.5
Paoli	70	0	40.9	5.69	4.5
Peru	76	2	36.5	3.03	14.0
Prairie Creek	67[e]	− 2[e]	37.0[e]	4.21	6.0
Princeton	71	2	40.6	5.43	8.0
Richmond	69	4	38.9	3.12	2.0
Rockville	69	− 3	36.2	3.35	12.0
Salem	69	− 1	39.2	5.46	4.2
Scottsburg	70	3	42.2	5.74	T.
Seymour	70	4	39.0	4.96	4.0
Shelbyville	70	1	41.0	3.77	0.8
South Bend	66	2	31.9	3.81	28.0
Syracuse	66	− 3	31.5	4.06	30.0
Terre Haute	68	0	38.3	4.54	11.0
Topeka	64	− 2	31.2	2.13	14.8
Valparaiso	64	4	30.0	......	......
Vevay	69	4	40.9	6.70	3.0
Vincennes	70	4	40.3	3.70	3.0
Washington	72	3	43.1	4.66	2.0
Winamac	71	2	33.3	3.96	10.4
Worthington	71	1	39.6	4.08	0.7
Indian Territory.					
Healdton	84	12	53.7	0.93	T.
Kemp	82	18	54.9	0.50	
Lehigh	81	19	51.0	0.32	
South McAlester	......	......	......	0.60	
Tahlequah	......	13	......	0.92	0.5
Tulsa	......	......	......	0.25	
Webbers Falls	......	......	......	1.26	
Iowa.					
Afton	65	− 1	28.2	1.25	2.0
Albia	65	− 5	30.6	2.02	9.0
Algona*[1]	38	−11	18.0	2.47	16.0
Alta *a*	45	− 9	19.0	1.58	17.3
Amana	61	− 8	27.0	0.63	T.
Ames *b*	62	− 7	25.0	0.49	2.5
Ames (near)	......	......	......	1.43	7.2
Atlantic	66	− 1	26.4	1.24	7.0
Audubon	62	− 3	24.6	1.20	12.0
Bancroft	43[e]	−11[e]	18.4[e]	1.03	8.5
Batavia	......	......	......	0.87	1.1
Bedford	68[d]	0[d]	28.3[d]	2.68	4.0
Belknap	61	− 1	29.6	3.10	17.5
Belleplaine	62	− 7	26.7	1.42	1.8
Bonaparte	66	− 2	30.4	3.08	10.0
Britt	40	−10	18.2	2.06	10.6
Burlington	......	......	......	3.83	14.0
Carroll	67	− 7	22.4	1.89	17.0
Cedarfalls	48	− 9	22.6	1.45	2.5
Cedar Rapids	64	− 5	26.8	0.53	0.8
Centerville	63	− 2	31.8	1.05	6.5
Chariton	64	− 3	28.2	1.42	6.2
Charles City	41	−16	20.5	1.56	5.0
Chillicothe	......	......	......	2.10	7.0
Clarinda	68	1	28.6	2.68	10.5
Clear Lake	58	−10	23.8	......	......
Clinton	63	− 3	29.0	1.89	7.2
College Springs	67	0	28.3	2.44	6.0
Coon Rapids	62[e]	− 4[e]	24.4[e]	0.81	3.8
Corning	66	0	28.0	1.77	11.0
Council Bluffs	68	1	27.6	0.72	5.5
Cresco	41	−16	16.9	2.34	10.0

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Iowa—Cont'd.	°	°	°	*Ins.*	*Ins.*
Danville	......	......	......	2.94	8.0
Decorah	43	−15	20.3	3.51	15.5
Delaware	50	−11	23.4	1.16	3.5
Denison	64	− 5	22.3	1.00	4.5
Desoto	66	0	27.4	0.84	3.4
Dows	52	−10	20.4	1.41	8.0
Eldon	66	− 1	31.2	2.21	11.8
Eldora	56	−10	21.4	1.45	4.5
Elkader	45	−13	23.8	1.69	5.0
Emerson	......	......	......	0.50	5.0
Estherville	38	−14	13.0	2.20	21.0
Fairfield	65	− 3	30.0	1.64	6.0
Fayette	45	−15	21.8	2.22	10.8
Forest City	47	−11	18.6	3.38	14.0
Fort Madison	......	......	......	3.47	7.5
Galva	57	− 5	21.6	1.43	......
Garden Grove	67	− 4	28.5	0.98	7.0
Glenwood	70	0	27.7	0.66	6.6
Grand Meadow*[1]	40	−10	20.6	1.80	8.8
Greene	42	−15	22.0	1.39	4.0
Greenfield	66	− 5	26.3	1.57	6.3
Grinnell	60	− 3	26.0	1.23	0.5
Grinnell (near)	61	− 5	26.0	1.46	......
Grundy Center	58	− 9	22.6	1.31	1.0
Guthrie Center	55	− 2	24.0	0.72	6.2
Hampton	45	− 8	20.9	2.05	4.2
Harlan	65	− 3	25.4	0.75	3.9
Hawkeye	......	......	......	1.70	11.5
Hedrick	64	− 3	29.2	1.17	4.6
Hopeville	63	− 1	27.6	1.35	......
Humboldt	53	− 7	21.6	0.95	8.7
Independence	47	−12	22.6	1.02	3.8
Indianola	64	− 2	27.8	1.06	1.7
Iowa City *a*	65	− 3	28.6	1.43	1.5
Iowa Falls	52	− 8	22.4	1.50	6.0
Keosauqua	65	0	31.2	3.15	14.1
Knoxville	63	0	28.9	1.31	3.5
Lamoni[e]	65	0	30.0	2.89	1.4
Lansing	45	−14	23.7	2.68	13.6
Larchwood	......	......	......	1.31	11.5
Larrabee	48	−11	18.8	1.40	14.2
Leclaire	......	......	......	1.63	4.0
Lemars	49	− 7	20.8	1.24	12.0
Lenox	63	− 2	27.4	1.28	2.7
Lockridge	......	......	......	1.75	8.0
Logan	54	− 3	20.7	1.30	13.0
Maple Valley	......	......	......	1.88	18.0
Maquoketa	60	− 3	31.8	0.65	3.0
Marshall	62	− 4	25.6	1.56	2.0
Mason City	42	−15	18.7	1.80	......
Melrose	......	......	......	0.82	7.0
Monticello	57	− 9	26.4	0.37	T.
Mooar	65	− 1	32.0	3.16	15.0
Mountayr	64	− 1	28.2	1.64	7.2
Mount Pleasant	......	− 1	......	1.86	4.0
Mount Vernon *a**[1]	66	− 8	26.6	0.50	......
Mount Vernon *b*	61	− 8	27.2	0.97	3.7
New Hampton	42	−13	20.8	1.61	6.0
Newton	62	− 3	26.8	0.74	1.5
North McGregor	......	......	......	1.22	11.0
Northwood	40	−10	18.9	2.83	14.0
Odebolt	61	− 4	23.6	0.72	6.0
Ogden	63	− 5	24.4	1.36	9.3
Olin	59[e]	− 7	26.5[e]	0.95	3.2
Onawa	63	− 5	25.8	0.91	9.8
Osage	44	−10	19.2	2.13	7.5
Osceola	65	− 1	27.8	0.86	4.0
Oskaloosa	64	− 2	28.6	0.71	4.2
Ottumwa	64	1	30.4	0.82	7.4
Ovid	63	− 2	28.8	2.07	8.8
Pacific Junction[g]	60	7	26.7	0.75	7.5
Parnell[d]	50	− 7	27.6	......	......
Pella	60	− 6	25.1	1.04	1.0
Plover	48	− 8	20.6	1.35	11.5
Primghar	40	−10	16.0	2.75	......
Redoak	69	1	29.5	1.23	......
Ridgeway	43	− 9	22.7	......	......
Rockwell City	60	− 6	21.8	1.62	18.0
Ruthven	39	−12	16.3	1.65	16.5
Sac City	57	− 6	20.8	1.61	14.1
Sheldon	44	−11	18.0	0.65	5.6
Sibley	46	−13	17.1	1.42	12.5
Sigourney	66	− 7	26.1	1.41	6.8
Spencer	46	−12	17.7	1.29	9.7
Storm Lake	43	− 8	18.8	1.02	10.0
Stuart	55	− 5	23.8	0.85	6.6
Tara	52	− 5	21.0	0.60	6.0
Thurman	69	1	28.6	2.38	20.6
Toledo	60	−10	26.0	1.66	2.0
Villisca	67	0	29.6	2.10	12.0
Vinton*[1]	56	− 7	25.9	2.13	4.2
Wapello	63	− 3	30.8	2.20	8.0
Washington	65	− 6	27.4	1.28	5.0
Washta	......	......	......	1.55	11.0
Waterloo	50	− 9	23.4	2.23	3.2
Waverly	47	−13	23.6	1.76	4.8

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Iowa—Cont'd.	°	°	°	Ins.	Ins.
Westbend *[1]	42	— 9	18.1	1.53	14.0
Westbranch	63	— 4	23.1	0.87	T.
Westunion				0.85	8.5
Whitten *[1]	58[c]	— 4[c]	23.6[c]	0.91	1.0
Wilton Junction	66	— 5	30.1	1.59	5.0
Winterset	64	— 1	27.4	1.62	
Woodburn				1.53	5.4
Kansas.					
Abilene	74	9	34.6	2.46	10.5
Achilles				0.83	7.8
Altoona *[2]	70	9	36.5	1.92	10.0
Anthony				2.04	5.0
Atchison *a*	68	4	32.2	3.42	16.5
Atchison *b* *[1]	68	6	32.6		
Augusta	75	8	40.9	1.21	3.5
Beloit [d]	68	9	34.2	0.83	10.0
Burlington	72	3	38.8	2.86	
Campbell	71	3	32.2	2.83	19.0
Centropolis				6.22	7.8
Chanute	70	7	39.6	2.05	11.0
Colby	82	0	33.9	0.56	5.4
Columbus	75	6	40.8	1.87	11.1
Coolidge	83	7	38.3	0.30	3.0
Cunningham	81	3	40.4	1.20	7.0
Delphos	76	9	35.7	1.13	5.8
Dresden	77	3	31.9	1.38	6.3
Ellinwood	78	0	35.8	1.22	10.2
Emporia	72	10	36.4	2.53	3.0
Englewood	87	4	41.6	0.36	3.5
Eskridge		9		1.85	7.5
Eureka				2.39	4.0
Eureka Ranch	80	6	34.8	0.30	3.0
Fallriver	75	6	41.8	1.57	5.2
Fanning	69	3	33.3	2.53	2.0
Fort Riley	72	8	38.9	1.90	5.0
Frankfort	73	3	34.3	3.10	16.0
Garden City	82	3	38.6	1.30	4.5
Gibson	82	6	35.2	0.48	4.0
Gove *[1]	82	13	34.8	0.35	3.5
Grenola	75	10	40.4	2.01	6.0
Halstead				2.30	1.0
Horton	69	4	32.4	3.87	21.5
Hoxie				0.90	9.0
Hutchinson	78	9	39.4	1.50	10.0
Independence	73	12	41.8	2.10	5.0
Lawrence	69	2	35.8	2.82	9.5
Lebo	70	4	36.4	3.98	7.2
McPherson	77	7	36.8	2.48	5.0
Manhattan *b*	73	8	34.6	3.31	12.4
Manhattan *c*	73	8	35.4	3.10	13.6
Marion	76	3	38.2	2.60	11.0
Meade	81	4	42.2	0.40	4.0
Medicine Lodge	81	7	40.8	0.73	5.0
Minneapolis	76	7	35.0	1.92	10.7
Morantown	68	— 1	38.4	1.74	8.0
Mounthope *[1]	76	12	37.6	1.95	6.0
Ness City	79	8	38.6	0.30	3.0
Newton	76	7	39.6	2.31	6.5
Norwich		5		1.72	
Oberlin				0.85	6.0
Olathe	67	2	36.8	3.16	5.0
Osage City	71	5	37.5	2.21	6.0
Osborne				0.33	2.5
Oswego	75	10	44.1	2.34	11.0
Ottawa	71	0[c]	36.3	2.85	9.5
Phillipsburg	78	4	34.8	0.40	4.0
Pittsburg				1.95	11.0
Pratt	78	13	40.0	0.75	4.0
Rome *[1]	79	8	41.0	1.73	10.0
Russell	76	6	35.4	1.06	6.2
Salina	76	10	35.3	2.37	13.8
Sedan	74	12	42.6	2.64	5.5
Seneca		4		2.13	15.0
Toronto	73	7	40.0	1.89	6.0
Ulysses				0.90	4.0
Valley Falls	70	4	34.9	2.72	9.5
Viroqua	84	10	42.0	0.70	5.0
Wallace				0.32	2.8
Wamego *[1]	70	6	32.6	3.42	22.0
Wellington	75	14	41.0	2.90	1.0
Winfield	78	9	42.0	2.10	8.0
Winona				0.20	2.0
Yates Center	63	3	35.4	2.47	8.5
Kentucky.					
Alpha *[5]	77	— 3	45.9	12.13	10.0
Ashland	74	8	46.4		
Bardstown	73	2	44.0	8.01	
Blandville	73	5	42.8	5.86	1.2
Bowling Green *b*	75	2	44.4	8.65	5.0
Burnside				11.94	1.0
Caddo	70	3	40.0	7.22	1.5
Canton *[1]	76	8	46.6	5.36	1.5
Carrollton	70	6	42.4		
Catlettsburg	74	9	46.7	8.13	T.
Earlington	74	5	44.2	6.19	2.5
Edmonton	72	1	46.6	10.73	5.1

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Kentucky—Cont'd.	°	°	°	Ins.	Ins.
Ensor		2		8.35	
Eubank	74	— 2	43.6	11.53	6.5
Falmouth				6.56	0.7
Fords Ferry	71	3	44.4	5.76	1.0
Frankfort				8.53	T.
Georgetown	70	0	42.8		
Greensburg	75	2	44.3	10.32	1.5
Henderson	72	5	43.7	6.52	1.2
Hopkinsville	78	3	46.7	6.81	1.0
Irvington	71	2	43.6	9.40	T.
Jackstown	71	2	43.5	9.00	1.0
Leitchfield	75	1	43.1	8.09	3.2
Loretto	74	0	45.2	8.43	1.2
Lyndon	73	3	42.8	7.07	T.
Marrowbone	76	0	44.8	10.81	8.0
Maysville	75	6	41.8	7.44	T.
Middlesboro	71	3	46.2	10.23	1.6
Mount Hermon	75	— 2	45.1	12.80	5.0
Mount Sterling	70	2	42.8	12.58	5.5
Owensboro	78	4	45.2	8.02	2.0
Owenton	70	2	41.3	6.61	2.1
Paducah *a*				5.42	2.0
Paducah *b*	76	6	44.9	5.88	2.0
Princeton	76	4	43.6		
Richmond	71	0	43.0	8.80	4.0
Russellville				6.39	T.
St. John	70	1	34.2	7.65	0.1
Scott	69	4	39.8	6.36	1.5
Shelby City	73	— 2	42.4	8.08	5.1
Shelbyville	72	3	43.6	8.33	0.8
Vanceburg	68	8	40.0	8.75	4.0
Williamsburg	74	2	48.4	8.26	T.
Louisiana.					
Abbeville	84	31	63.5	1.35	
Alexandria	86	29	61.4	3.19	
Amite	90	28	63.0	2.48	
Bastrop	85	27	59.6	7.07	
Baton Rouge	89	32	62.5	3.04	
Calhoun	85	27	56.8	4.83	
Clinton	89	29	63.0	1.92	
Donaldsonville	88	31	62.0	0.72	
Emilie	83	32	61.6	1.60	
Farmerville [e]	83	26	56.4	6.10	
Franklin	84	34	63.4	1.29	
Grand Coteau	87	32	63.6	1.20	T.
Hammond	89	30	64.2	2.20	
Houma	88	32	65.7	0.26	
Jeanerette	82	28	60.6	1.47	
Jennings	84	31	63.2	1.54	
Lafayette	89	31	62.2	1.45	
Lake Charles	80	34	62.5	2.97	
Lake Providence	88	26	59.4	8.44	
Lawrence	86	36	65.1	1.34	
Liberty Hill	89	26	58.7	7.60	
Mansfield	86	27	56.0	6.34	
Melville	85	31	61.8	2.89	
Minden	84	26	56.2	4.65	
Monroe	85	28	58.0	4.83	
Montgomery	86	28	61.0	2.50	
New Iberia	83	32	62.0	1.20	
Oakridge	87	28	58.3	7.33	
Opelousas	85	30	61.0	2.07	
Oxford	86	27	58.0	5.78	
Paincourtville	90	32	64.8	1.50	
Plain Dealing	85	25	56.9	2.36	
Plaquemine	90	25	63.5	1.00	
Rayne	86	31	62.0	1.33	
Robeline	85	25	60.3	3.95	
Ruston				8.81	
Schriever	87	31	63.8	0.69	
Shellbeach	83	34	62.2	0.79	
Southern University	82	32	62.0	2.60	
Sugar Ex Station	84	35	63.0	3.30	
Sugartown	82	31	62.6	2.58	
Venice	88	37	63.2	2.00	
Wallace	91	31	64.4	1.52	
White Sulphur Springs				3.36	
Maine.					
Bar Harbor	52	3	29.0	7.15	26.5
Belfast *[6]	46	7	28.1	5.86	26.0
Calais	46	— 1	27.2	5.23	24.0
Cornish *[1]	57	6	27.3	6.22	43.0
Cumberland Mills	53	0	28.8	6.72	26.8
Fairfield	53	—14	27.0	3.66	24.0
Farmington	47	—12	25.6	5.79	43.5
Flagstaff	55[c]	—15[c]	21.8[c]	4.05	38.0
Gardiner	48	2	28.4	5.56	28.0
Kineo	43	— 5	21.6		
Lewiston	49	— 1	26.8	5.96	32.2
Mayfield	44	— 7	24.0	4.87	28.0
North Bridgton	51	— 1	26.9	6.58	44.0
Orono	51	— 3	26.0	4.76	28.0
Petit Menan *[1]	40	15	30.8		
Winslow	49	—12	28.0	4.10	24.0
Maryland.					
Annapolis	74	27	44.4	5.49	

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Maryland—Cont'd.	°	°	°	Ins.	Ins.
Bachmans Valley	68	18	37.5	6.78	3.0
Boettcherville	76	12	43.1	3.62	2.0
Boonsboro *a*	75	18	40.0	3.31	2.0
Boonsboro *b*	72	15	39.0	2.44	3.0
Cambridge	71	26	42.9	5.74	0.4
Charlotte Hall	75	18	44.3	4.61	6.0
Chase	70	21	40.0	5.54	0.5
Chestertown	69	25	41.2	5.59	4.0
Chewsville	74	18	39.9		
Clear Spring	75	15	38.1	5.11	4.0
Coleman	68	24	40.7	6.12	3.0
Collegepark	71	22	43.0	5.90	4.0
Cumberland *b*	71	18	43.7	4.51	0.8
Deerpark	70	3	37.9	5.71	9.0
Denton	74	26	40.9	5.25	8.0
Easton	70	24	42.4	4.70	10.0
Ellicott City	76	22	40.6	5.63	1.8
Fallston	70	23	39.6	5.05	2.5
Frederick	72	21	41.2	4.58	1.2
Frostburg	71	7	37.9	5.34	6.8
Grantsville	68	5	34.9	5.24	10.0
Greatfalls	74	19	40.6	4.16	0.5
Greenspring Furnace	75	19	41.5	4.11	2.5
Hagerstown	75	18	40.0	3.52	2.0
Hancock	77	12	40.0	3.81	3.0
Harney				4.92	4.0
Jewell	74	20	41.7	4.46	4.0
Johns Hopkins Hospital	74	24	40.0	5.75	3.5
Laurel	74	19	42.1	5.29	3.0
Mardela Springs	71	25	43.7	4.74	
Mount St. Marys Coll.	71	20	38.3	4.48	2.8
New Market	73	19	40.2	4.67	3.0
Ocean City [1]	60	30	45.4	3.78	
Pocomoke City	72	24	46.4	4.26	4.0
Port Deposit	74	23	40.9		
Princess Anne	72	24	44.3	4.74	3.0
Rockhall *a*	65	26	42.2	5.07	1.6
Rockhall *b*	66	25	41.9	4.99	2.0
Sandy Point				4.25	4.0
Sharpsburg	74	19	40.5	3.31	1.0
Smithsburg *a*	72	18	39.4	3.61	3.0
Smithsburg *b*	73	16	39.1	4.25	4.5
Solomons	70	22	42.3	5.28	6.0
Sudlersville	72	25	44.2	4.78	6.0
Sunnyside	68	1	36.3	7.42	15.0
Taneytown	71	21	39.9	2.98	5.0
Van Bibber	64	24	39.7	6.15	3.0
Westernport	72	12	39.2	4.29	2.2
Westminster	71	20	38.1	4.95	2.0
Woodstock	73	21	40.6	4.87	3.0
Massachusetts.					
Adams	55	8	30.9		
Amherst	52	9	31.5	6.96	22.0
Attleboro				8.03	
Bedford	57	14	33.3	6.06	24.0
Bluehill (summit)	59	11	31.6	6.45	21.0
Cambridge	63	14	33.2	6.67	
Chestnut Hill	62	14	33.1	7.05	14.2
Cohasset				7.18	
Concord	60	13	30.8	3.98	15.3
Dudley				4.94	
East Templeton *[1]	50	10	29.0	4.18	17.5
Fallriver	58	17	35.6	7.37	11.8
Fiskdale				5.21	
Fitchburg *a* *[1]	50	12	29.6	6.87	27.0
Fitchburg *b*	56	8	29.7	7.36	25.0
Framingham	60	14	33.4	7.05	
Groton	57	9	29.4	6.86	27.0
Hyannis *[1]	52	18	35.4	8.33	6.8
Jefferson				6.90	20.0
Lawrence	59	11	32.1	6.41	17.5
Leeds	53	8	30.3	7.77	35.5
Leominster				6.35	22.8
Long Plain				7.81	3.0
Lowell *a*	59	12	31.5	7.95	
Lowell *b*	60	10	31.4		
Ludlow Center	49	4	27.3	6.52	14.[illegible]
Mansfield *[1]	56	15	31.0	8.12	8.0
Middleboro	57	15	33.9	6.53	4.0
Monson	58	10	31.4	6.51	18.5
New Bedford *a*	53	18	34.8	7.35	4.0
New Bedford *b*	55	16	35.7	7.84	3.8
New Salem	51	7	28.2	6.67	26.0
Pittsfield	51	5	28.0	6.55	32.0
Plymouth *[1]	60	16	34.8	6.76	
Princeton	60	16	34.8	6.55	28.5
Salem				6.98	20.2
Somerset *[1]	56	16	36.3	7.84	7.0
South Clinton				6.83	22.5
Springfield Armory	53	17	33.4	6.80	17.0
Sterling				6.71	25.5
Taunton *b*	56	15	33.8	7.12	
Taunton *c*	56	15	33.6	7.10	
Turners Falls	50	8	29.3	6.58	27.5
Webster				6.20	18.2
Westboro	61	11	33.1	6.31	16.5

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Massachusetts—Cont'd.	°	°	°	*Ins.*	*Ins.*
Weston	59	14	33.1	6.69	24.5
Williamstown	54	5	28.2	4.05	......
Winchendon	......	......	......	5.61	20.5
Worcester *a*	56	12	30.1	......	......
Worcester *b*	60	7	30.5	7.29	17.2
Michigan.					
Adrian	62	8	29.3	3.87	20.5
Agricultural College	61	5	26.3	3.30	25.8
Allegan	64	−1	32.2	4.84	29.5
Alma	58	0	25.0	3.55	28.5
Ann Arbor	60	6	28.6	3.55	17.5
Arbela	55	5[d]	24.1[d]	3.91	32.0
Baldwin	52	−20	22.2	2.70	21.0
Ball Mountain	54	5	27.4	3.48	21.9
Baraga	35	−18	7.8	2.90	29.0
Battlecreek	68	4	28.9	3.61	23.0
Bay City	55	12	30.1	3.02	27.5
Berlin	55	4	26.2	4.46	31.4
Berrien Springs	65	0	30.4	6.72	50.2
Big Rapids	52	−4	22.8	3.84	20.5
Birmingham	58	7	28.4	3.55	20.4
Boon	48	−3	18.5	2.72	20.6
Calumet	32	−7	14.4	1.08	13.0
Camden	64	5	30.4	2.03	......
Carsonville	53	3	24.2	4.05	38.0
Charlevoix	43	−19	19.4	3.00	21.0
Cheboygan	41	−9	19.2	3.72	7.0
Clinton	64	8	30.2	3.77	18.5
Coldwater	65	3	30.0	3.73	27.7
Eloise	60	11	30.6	3.25	11.8
Fairview	59	8	29.4	3.45	26.8
Fitchburg	60	8	27.9	4.48	29.0
Flint	58	1	25.9	3.66	18.5
Frankfort	48	1	24.0	2.99	13.6
Gladwin	50	1	23.6	3.28	26.0
Grand Rapids	62	5	26.9	3.60	16.0
Grape	64	6	30.8	3.91	23.9
Grayling	48	−12	18.3	4.95	51.0
Hanover	54	6	28.0	2.94	16.8
Harrison	48	−1	21.2	1.72	17.0
Harrisville	47	0	21.6	4.24	36.0
Hart	58	−2	25.0	1.25	8.7
Hastings	61	4	27.4	3.47	27.2
Hayes	53	−5	22.8	3.54	29.5
Highland Station	......	......	......	4.38	22.5
Hillsdale	64	5	28.8	4.01	25.5
Holland *[9]	48	10	30.0	......	......
Howell	60	18	35.6	2.31	12.0
Humboldt	32	−18	8.4	2.46	11.0
Ionia	60	3	27.8	......	......
Iron Mountain	40	−9	16.9	2.98	21.8
Ishpeming	33	−12	13.4	5.49	41.3
Ivan	49	−2	21.6	2.43	28.0
Jackson	62	7	29.1	3.43	20.0
Jeddo	54	2	24.2	3.89	24.1
Kalamazoo	62	1	29.7	4.74	12.0
Lake City	66	−3	20.0	2.50	25.0
Lansing	61	7	26.9	3.17	26.5
Lapeer	58	−8	21.3	3.95	36.5
Lathrop	36[c]	−21[c]	13.2[c]	2.75	27.5
Ludington	51	2	23.6	2.16	11.2
Luzerne	49	−6	19.2	3.57	25.0
Mackinaw City	37	−13	16.6	1.83	7.0
Madison	64	7	30.3	3.57	15.8
Mancelona	46	−9	19.3	2.80	20.5
Manistee	......	......	......	2.30	23.0
Manistique	34	−7	17.6	2.72	16.0
Middle Island *[10]	42	1	22.0	......	......
Midland	......	......	......	1.90	18.0
Mottville	66	−2	30.4	4.64	29.0
Mount Clemens	68	7	28.4	4.02	7.5
Mount Pleasant	48	1	22.4	3.96	36.0
Muskegon	56	3	25.0	1.75	14.0
Newberry	33	0	18.0	1.40	14.0
North Manitou Island *[10]	40	1	22.0	......	......
Northport	40	2	23.4	2.25	17.5
Old Mission	45	2	21.4	2.31	23.1
Olivet	60	5	28.8	4.04	24.0
Omer	52	0	21.7	3.80	29.0
Ovid	60	6	26.2	3.73	26.0
Owosso	61	4	27.0	4.74	24.0
Parkville	......	......	......	4.53	24.0
Petoskey	44[d]	−8[d]	18.8[d]	2.32	10.0
Plymouth	55	6	23.5	3.59	19.0
Port Austin	51	4	23.7	4.08	34.0
Powers	38	−8	16.8	2.40	24.0
Reed City	50	−12	20.8	2.68	18.5
Rockland *	39	−8	14.8		
Rogers City	37	−9	17.6	3.49	17.0
Romeo	......	8	......	4.21	15.0
Saginaw	60	5	26.1	5.56	36.2
St. Ignace	47	−14	18.2	1.86	11.0
St. Johns	60	6	26.6	3.14	19.0
St. Joseph	62	4	30.9	2.26	5.0
Sandbeach	52	3	24.3	2.47	20.7
Sidnaw	37	−21	10.6	2.28	22.8

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Michigan—Cont'd.	°	°	°	*Ins.*	*Ins.*
Somerset	60	7	28.0	2.70	21.0
South Haven	62	5	30.3	1.73	7.5
Stanton	57	2	24.7	1.33	12.0
Thomaston	38	−15	12.7	2.80	28.0
Thornville	56	10	27.6	4.34	32.0
Thunder Bay Island *[10]	42	2	24.0	......	......
Traverse City	48	1	20.6	1.52	12.5
Valley Center	57	2	28.7	6.53	36.1
Vandalia	64	−2	29.6	4.54	28.2
Vassar	56	−1	24.8	4.80	39.9
Vermillion Point *[10]	32	−10	13.7	......	......
Wasepi	65	0	29.6	4.27	26.0
Waverly	62	−8	27.0	2.15	13.7
Wetmore	32[c]	−21[c]	11.8[c]	2.49	27.0
White Cloud	55	2	25.8	......	......
Ypsilanti	52	8	27.6	3.89	20.3
Minnesota.					
Ada	46	−20	10.3	0.98	11.5
Albert Lea	37	−11	17.2	1.67	9.8
Alexandria	44	−19	14.9	0.52	5.2
Beardsley	56	−16	14.4	0.58	4.0
Bermidji	39	−24	12.2	0.83	8.3
Bird Island	39	−14	15.8	1.16	9.8
Blooming Prairie	39	−12	17.6	0.90	8.5
Brainerd	34	−19	11.6	0.65	......
Caledonia	42	−13	18.4	2.50	16.2
Camden	47	−14	14.5	1.83	9.5
Collegeville	38	−14	17.8	1.09	10.2
Crookston	43	−22	10.7	0.55	6.0
Deephaven	......	......	......	2.62	26.5
Detroit City	40	−24	6.7	1.22	12.0
Farmington	36	−15	15.4	3.20	27.0
Fergus Falls	42	−18	14.1	0.71	7.1
Glencoe	39	−10	18.0	0.99	......
Glenwood	46	−18	17.0	0.59	3.0
Grand Meadow	40	−12	15.2	2.72	21.3
Hallock	38	−30	8.2	......	......
Lake City	36	−16	18.1	2.14	14.0
Lake Jennie	38	−13	17.5	1.67	16.0
Lakeside	38	−15	16.0	0.98	8.5
Lake Winnibigoshish	37	−25	8.8	0.87	8.0
Leech Lake	36	−29	9.8	0.47	6.1
Leroy	37	−13	20.1	......	......
Long Prairie	33	−18	13.0	0.59	5.4
Luverne	49	−7	18.3	2.91	21.5
Lynd	51	−13	17.8	1.25	5.6
Mapleplain [1]	40	−15	15.7	3.20	30.2
Milaca	42	−17	14.2	0.60	6.0
Milan	41	−15	15.0	1.72	13.2
Minneapolis *a*	34	−14	16.6	2.39	22.2
Minneapolis *b* [1]	34[a]	−15	16.2	2.07	19.5
Minnesota City *[1]	40	−10	21.5	2.47	9.5
Montevideo	43	−15	15.3	1.02	10.1
Morris	44	−16	15.8	0.30	3.0
Mount Iron	34	−25	10.6	0.87	11.0
Newfolden	40	−27	7.5	0.55	3.0
New London	42	−16	14.6	0.70	4.3
New Richland *[1]	36[c]	−10	18.9	......	......
New Ulm	40	−12	15.0	6.51	23.8
Park Rapids	36	−27	9.3	0.91	9.1
Pine River	38	−27	10.2	1.05	12.2
Pipestone	51	−13	14.7	1.57	9.2
Pleasant Mounds	40	−11	17.1	2.98	18.8
Pokegama Falls	36	−38	−8.2	0.58	5.9
Redwing	......	......	......	1.95	10.0
Reeds	......	......	......	2.40	13.5
Rolling Green	38	−11	15.5	3.40	31.0
St. Charles	39	−14	18.0	2.22	8.0
St. Cloud	34	−15	14.9	2.22	14.5
St. Olaf	41	−18	14.3	0.68	7.8
St. Peter	37	−9	18.6	2.27	19.5
Sandy Lake Dam	33	−27	10.2	0.65	9.1
Shakopee	36	−11	18.6	1.93	19.3
Slayton	50	−14	15.8	0.80	8.0
Tower	40	−33	4.4	1.30	13.0
Two Harbors	42	−13	14.8	0.69	7.0
Wabasha *[1]	37	−11	19.7	2.09	12.5
Willmar	37	−15	14.6	0.60	7.0
Willow River	41	−29	14.1	0.61	6.7
Winnebago City	41	−8	16.6	2.81	......
Worthington *	41	−13	14.6	3.25	24.6
Zumbrota [1]	36[a]	−15	17.8	......	......
Mississippi.					
Aberdeen	78	16	50.9	7.07	
Agricultural College	82	18	55.5	8.84	
Austin	81	17	53.2	4.37	T.
Batesville	77	17	51.0	4.66	
Bay St. Louis	81	32	62.0	5.62	
Biloxi	76	34	60.4	11.67	
Booneville	76	9	48.8	6.79	1.5
Briers	84	30	57.9	4.48	
Brookhaven	89	27	62.1	2.81	
Burke	81	18	54.0	6.20	
Canton	84	26	57.8	7.51	
Columbus *a*	......	......	......	10.71	T.
Columbus *b*	......	20	......	8.83	T.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Mississippi—Cont'd.	°	°	°	*Ins.*	*Ins.*
Crystal Springs	88	27	59.0	4.06	
Edwards	86	28	58.6	4.71	
Fayette	87	29	59.8	4.50	
Greenville *a*	78	24	54.4	5.44	
Greenville *b*	82	24	55.2	5.21	
Greenwood	82	27	55.4	9.97	
Hattiesburg	86	30	61.4	2.05	
Holly Springs	78	13	49.4	5.68	
Kosciusko	81	19	55.4	8.55	
Lake	89	22	55.5	3.75	
Leakesville	87	27	61.6	3.55	
Logtown	86	32	64.0	3.11	
Louisville	82	18	50.8	6.78	0.5
Macon	85	22	56.4	6.94	
Magnolia	87	28	61.2	5.04	
Natchez	87	30	62.0	4.15	
Okolona	81	9	54.8	5.71	
Palo Alto	83	18	54.8	6.62	
Pontotoc	81	15	52.6	8.27	0.2
Port Gibson	86	28	60.5	4.43	
Ripley	79	10	48.2	7.37	1.0
Rosedale	80	21	52.7	3.65	
Stonington *[1]	84	28	60.3	......	
Thornton	88	30	62.6	......	
Tupelo	......	......	......	8.32	
University	81	15	52.2	6.71	T.
Walnut Grove	87	23	60.8	4.89	
Water Valley *[1]	83	17	53.0	8.49	T.
Waynesboro	88	28	59.8	4.01	
Windham	87	29	59.3	6.28	
Woodville	86	28	60.8	4.42	
Yazoo City	90	26	57.8	7.44	
Missouri.					
Appleton City	74	0	39.6	2.32	9.1
Arlington	......	......	......	1.59	......
Arthur *[3]	......	4	37.0	2.25	9.5
Avalon	65	2	34.0	2.28	12.0
Bagnell	......	......	......	3.72	8.0
Bethany	65	2	31.0	4.20	18.0
Birchtree	75	4	42.7	2.51	0.5
Boonville	......	......	......	4.70	4.4
Brunswick	69	0	32.5	3.25	7.5
Carrollton	67	6	36.6	3.32	17.5
Conception	68	1	31.2	2.41	14.0
Cook Station	73	3	41.8	2.25	8.5
Cowgill *[5]	68	5	32.9	2.58	11.0
Darksville	66	1	31.4	1.45	8.0
East Lynne *[3]	......	3	33.9	2.37	10.7
Edgehill *[5]	66	6	38.4	3.08	2.2
Eightmile *[1]	66	2	36.9	2.43	7.1
Eldon	74	3	39.3	2.99	14.0
Elmira	66	3	33.8	2.15	12.0
Fairport	......	......	......	2.80	13.7
Farmersville	......	......	......	2.86	16.5
Fayette	70	0	34.8	2.21	5.0
Fulton	......	......	......	3.75	9.5
Galena	......	......	......	1.65	1.9
Gallatin *[1]	64	5	31.8	4.49	19.3
Gayoso	76	8	47.2	3.96	T.
Glasgow	72	2	34.8	3.10	......
Gordonville *[3]	......	6	39.8	4.02	7.0
Gorin	......	......	......	2.81	12.5
Halfway	73	4	41.2	1.74	1.0
Harrisonville	68	1	34.9	2.37	7.2
Hermann	......	......	......	2.71	3.0
Houston	75	6	43.2	2.16	2.0
Houstonia	......	......	......	3.19	6.4
Irena	......	......	......	3.35	11.5
Ironton	72	2	40.6	3.54	2.0
Jefferson City	70	3	37.8	3.75	10.3
Kidder	64	3	31.6	3.66	14.9
Lamar	76	1	41.7	2.53	14.0
Lamonte	......	......	......	2.39	5.0
Lebanon	72	5	40.3	2.48	5.5
Lexington	68	5	36.0	2.84	3.0
Liberty	68	1	33.0	3.57	8.2
Louisiana	71	0	36.9	3.03	13.2
McCune *[1]	66	−8	35.6	3.83	12.0
Marblehill	75	4	42.6	3.46	3.5
Marshall	70	3	34.2	2.92	9.0
Maryville	59	0	27.0	2.61	12.8
Mexico	71	−2	36.4	2.58	9.0
Miami	......	......	......	2.98	8.0
Mineralspring	75	3	42.5	1.09	3.0
Montreal	72	3	39.8	2.81	14.5
Mount Vernon	74[c]	9[c]	42.5[c]	1.88	2.5
Neosho	76	−2	44.0	1.56	3.4
Nevada	......	......	......	1.80	10.0
New Haven	71	4	38.2	3.40	14.5
New Madrid	......	......	......	6.67	2.0
New Palestine	77	2	40.3	2.75	7.5
Oakfield	70	0	40.0	4.83	16.2
Olden	72	4	41.8	1.83	1.0
Oregon *a*	69	2	31.0	4.55	23.4
Oregon *b*	68	3	32.6	4.34	24.8
Palmyra *[5]	68	4	34.9	2.97	19.5

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Missouri—Cont'd.	°	°	°	*Ins.*	*Ins.*
Phillipsburg*1	72	4	39.5	1.58	2.8
Pickering*3	......	6	27.8	2.17	9.5
Poplarbluff	77	7	46.4	3.11	1.5
Potosi	69	— 2	39.8	2.75	7.0
Princeton	65	3	30.0	4.71	17.0
Rhineland	71	3	39.4	4.29	9.0
Richmond	65	5	33.0	3.04	6.5
Rolla	......	......	......	2.66	9.0
St. Charles	70	— 2	38.0	3.25	12.0
St. Joseph	......	......	......	3.62	14.5
Sarcoxie*3	......	0	36.1	1.20	2.5
Sedalia	72	— 2	38.0	2.32	11.0
Seymour	71	4	40.2	1.72	1.0
Shelbina	......	......	......	2.30	10.0
Sikeston	77	6	43.0	4.78	1.5
Steffenville	66	2	34.3	2.99	19.5
Stellada	71	— 8	37.8	2.33	10.0
Sublett	66	— 1	31.4	7.03	15.2
Trenton	64	3	33.4	2.94	15.5
Unionville	......	......	......	2.88	8.0
Vichy	74	0	41.7	2.80	8.0
Warrensburg	71	2	38.0	2.58	5.5
Warrenton	69	1	35.6	3.16	10.0
Wheatland	......	......	......	2.90	10.5
Willow Springs	72	5	42.1	2.30	0.5
Wylie	78	— 3	45.3	1.36	1.0
Zeitonia	77	6	44.3	1.75	4.0
Montana.					
Adel	60	—23	18.0	1.29	10.6
Augusta	57	—17	25.8	......	......
Big Timber	56	— 4	28.6	0.62	8.0
Billings	58	— 9	25.2	0.30	3.0
Boulder	54g	—10g	20.8g	0.70	7.0
Butte	46	4	26.4	1.21	12.2
Canyon Ferry	52	— 5	23.3	0.88	......
Castle	44	—18	18.4	1.17	......
Chinook	49	—26	8.4	0.43	4.2
Corvallis	56	9	33.4	0.59	5.7
Crow Agency	54	— 9	24.4	0.64	16.0
Dearborn Canyon	49	—16	19.5	1.60	16.0
Deer Lodge	51	— 6	30.2	0.90	9.0
Dell	52	— 1	25.8	0.47	......
Dupuyer	52	—15	17.6	......	......
Florence	54	12	31.0	1.86	......
Fort Keogh	57	—24	14.0	2.53	25.2
Fort Logan	50	—21	17.3	0.64	......
Glasgow	46	—31	6.8	1.35	......
Glendive	50	—17	13.8	1.70	17.0
Glenwood	48	—12	21.8	2.37	......
Greatfalls	56	— 8	22.0	0.47	7.4
Kalispel	68	5	28.8	0.25	2.5
Kipp	51	—18	15.8	1.83	18.4
Lewistown	58	— 8	20.2	1.80	18.0
Livingston	52	— 5	25.8	1.20	11.9
Manhattan	54	— 5	26.3	0.36	3.5
Martinsdale	50	— 8	23.2	1.00	10.0
Marysville	45	—11	20.2	1.74	23.0
Missoula	52	7	32.0	2.04	10.8
Parrot	52	0	26.6	0.63	6.2
Plains	52	9	32.2	0.75	7.5
Poplar	46	—27	8.6	0.63	6.3
Redlodge	56	—14	21.8	2.30	23.0
Ridge	55	10	19.2	......	......
St. Ignatius	55	5	33.1	0.57	7.8
St. Pauls	48	—18	14.2	......	......
Shelby	52	—19	15.0	1.90	19.0
Troy	60	4	34.6	1.44	8.0
Utica	51	—10	21.3	0.92	......
Wibaux	50	—15	18.2	0.32	3.2
Yale	58	— 6	24.6	1.90	19.0
Nebraska.					
Agee*1	65	— 2	21.7	1.02	......
Albion	75	— 4	26.0	0.67	5.0
Alliance	......	......	......	0.88	7.0
Alma	82	7	33.0	0.73	4.2
Ansley	76	— 5	26.4	0.55	5.6
Arapaho*1	70	10	31.8	0.30	3.0
Arborville*1	70	— 2	29.8	0.35	1.0
Ashland *a*	69	0	27.6	0.45	7.5
Ashland *b**1	70	0	28.3	0.65	5.5
Ashton	......	......	......	0.64	4.0
Auburn	71	0	30.4	2.21	17.5
Aurora*1	67	3	28.6	0.20	2.0
Bartley	......	......	......	0.45	5.0
Bassett	......	......	......	3.40	10.0
Beatrice	70	0	28.8	1.34	12.2
Beaver City	82	4	32.8	0.60	2.5
Bellevue	......	......	......	0.44	5.0
Benedict	......	......	......	0.56	2.5
Benkleman	......	......	......	0.87	8.7
Blair	67	— 2	23.7	0.63	3.7
Bluehill	......	......	......	0.70	4.0
Bradshaw	......	......	......	0.15	0.5
Brokenbow	......	......	......	0.32	4.2
Burchard	......	......	......	1.00	10.0
Burwell	......	......	......	0.05	T.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Nebraska—Cont'd.	°	°	°	*Ins.*	*Ins.*
Callaway	54	0	27.8	T.	T.
Camp Clarke	69	—13	29.8	1.40	14.0
Central City	......	......	......	0.10	1.0
Chester	......	......	......	0.41	0.4
Clatonia	58	0	27.0	0.91	9.1
Cody	......	......	......	0.19	......
Columbus	68	— 1	25.9	0.81	0.5
Creighton	66	—10	21.2	0.36	3.0
Crete	69	0	27.4	0.77	6.5
Culbertson	......	......	......	0.94	7.2
Curtis	77	— 1	31.0	1.16	3.5
David City	65	—10	26.7	0.45	4.5
Dawson	71	— 2	31.9	2.48	17.5
Dunning	......	......	......	0.20	2.0
Eden	......	......	......	1.85	14.5
Edgar *a*	......	......	......	0.40	4.0
Edgar *b*	......	......	......	0.64	4.0
Elba	......	......	......	0.40	4.0
Ericson*1	72	— 5	22.5	0.80	8.0
Ewing	......	......	......	1.38	7.0
Fairbury	73	2	29.2	1.40	9.0
Fairfield	......	......	......	0.32	3.2
Fairmont	68	1	29.2	0.36	1.2
Fort Robinson	64	— 6	23.8	1.76	17.8
Franklin	81	7	32.0	0.90	8.0
Fremont	65	— 5	26.0	0.87	6.5
Geneva	64	2	29.0	1.10	6.0
Genoa	74	— 2	25.4	0.59	2.5
Gering	66	—10	26.4	1.92	19.2
Gordon	......	......	......	1.40	......
Gothenburg	76	3	31.6	0.50	5.0
Grand Island *a**1	78	— 2	30.4	0.97	5.2
Grand Island *b*	77	— 2	28.4	0.99	6.4
Grand Island *c*	62	— 7	25.0	......	......
Greeley	......	......	......	0.35	3.5
Haigler	......	......	......	0.52	5.2
Hartington	58	— 7	18.2	1.45	13.2
Harvard	73	0	28.6	0.96	6.6
Hastings*1	72	1	27.4	1.02	7.2
Hayes Center	......	......	......	1.33	13.5
Hay Springs	59	— 6	20.5	2.94	30.8
Hebron	66	3	30.0	1.13	7.8
Hickman	......	......	......	0.70	7.0
Holdrege*1	76	2	24.1	0.20	2.0
Hooper*1	62	0	25.4	1.28	7.2
Imperial	75	— 8	31.8	1.90	12.0
Kearney	......	......	......	0.60	6.0
Kennedy	64	— 5	24.2	2.27	19.0
Kimball	67	—15	29.2	0.68	6.3
Kirkwood*1	61	— 3	20.6	0.88	8 8
Lexington	79	—11	28.0	1.40	14.0
Lincoln *b*	77	2	29.4	0.65	......
Lincoln *d*	70	3	29.6	0.76	6.9
Lodgepole	71	—12	29.5	0.80	8.0
Loup*1	74	— 2	26.1	0.44	T.
Lynch*1	62	—11	22.2	0.59	3.2
Lyons	......	......	......	1.25	8.2
McCook	......	......	......	0.60	6.0
McCool	......	......	......	0.44	2.5
Madison	65	—12	21.8	0.62	2.0
Madrid*5	73	— 5	27.4	1.10	10.0
Marquette	......	......	......	0.27	1.5
Merriman	......	......	......	0.80	8.0
Minden *a*	76	0	28.3	1.11	8.4
Monroe	......	......	......	0.70	3.1
Nebraska City *b*	......	......	......	1.25	9.0
Nebraska City *c*	70	0	29.0	......	......
Nemaha*1	70	0	29.6	1.53	13.0
Nesbit	72	— 7	26.2	0.90	8.0
Norfolk	66	— 6	22.2	0.54	1.1
North Loup	76	— 4	27.2	0.74	1.5
Oakdale	70	— 4	22.2	0.80	5.8
Odell	......	......	......	0.96	9.0
O'Neill	60	—10	21.7	0.63	6.3
Ord	......	......	......	0.75	......
Osceola	......	......	......	0.50	1.0
Ough	......	......	......	0.70	7.0
Palmyra*1	67	3	27.6	0.80	3.4
Paxton	......	......	......	1.66	10.5
Plattsmouth *a*	......	......	......	1.02	10.0
Plattsmouth *b*	......	......	......	0.90	8.5
Pleasant Hill	......	......	......	2.03	14.0
Ravenna *a*	78	— 2	28.8	0.90	8.4
Ravenna *b*	......	......	......	0.62	6.0
Redcloud *a*	......	......	......	0.95	6.0
Republican*1	76	6	31.8	0.15	1.5
Rulo	......	......	......	3.40	15.0
St. Libory	......	......	......	0.72	3.8
St. Paul	......	......	......	0.61	3.2
Salem*1	68	0	30.4	2.15	18.0
Santee Agency	62	— 7	21.6	1.16	9.7
Schuyler	......	......	......	0.30	3.0
Seneca*1	52	0	27.2	0.10	1.0
Seward*1	62	2	27.3	0.52	1.2
Spragg	......	......	......	0.61	6.1
Springview	58	— 1	21.1	0.81	8.1

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Nebraska—Cont'd.	°	°	°	*Ins.*	*Ins.*
Stanton	......	......	......	0.69	4.7
State Farm	70	2	29.5	0.52	5.0
Stockham	......	......	......	0.50	2.0
Strang*1	60	0	24.6	0.90	5.0
Stratton	......	......	......	0.90	5.0
Superior*5	58	4	32.4	1.00	8.0
Syracuse	......	......	......	0.97	5.5
Tablerock	......	......	......	2.19	18.0
Tecumseh *b*	70	2	29.5	0.50	5.0
Tecumseh *c*	......	......	......	1.25	9.5
Tekamah	66	— 3	25.4	0.60	4.0
Thedford	......	......	......	0.35	5.0
Turlington	69	0	27.8	1.61	12.6
Valentine	64	— 8	23.0	1.28	......
Valparaiso	......	......	......	0.77	3.8
Wakefield	59	— 7	21.5	0.83	8.4
Wallace	......	......	......	0.91	5.8
Wauneta	......	......	......	1.90	14.0
Weeping Water*1	71	— 5	25.3	1.32	10.5
Wellfleet	85	4	33.8	1.75	10.5
Westpoint	59	— 5	24.2	0.62	2.0
Whitman	......	......	......	0.55	5.5
Wilber*1	74	2	30.0	0.85	6.0
Wilsonville*1	78	2	30.8	0.40	3.0
Wisner	......	......	......	0.73	1.2
Wymore*1	70	3	31.3	1.54	9.0
York*1	65	0	27.8	0.10	......
Nevada.					
Battle Mountain*1	61	27	42.0	2.23	1.0
Blaine[h]	50	10	31.9	......	......
Candelaria	75	13	42.2	0.65	1.5
Carlin*1	54	18	30.8	......	......
Carson City	73	9	40.4	2.29	3.6
Cranes Ranch	......	......	......	2.74	......
Ely	64	10	35.2	1.90	8.0
Empire Ranch	62	4	34.1	0.58	11.0
Fenelon*1	57	14	30.9	0.98	15.0
Golconda*1	56	12	38.6	......	......
Halleck*1	63	7	33.0	5.00	12.8
Hawthorne *b*	75	19	44.8	0.10	1.0
Hot Springs*1	65	14	46.5	......	......
Lee	......	......	......	8.49	14.5
Lewers Ranch	69	8	39.0	8.51	7.1
Los Vegas	78	24	47.8	0.00	
McGill	65e	8e	35.3e	1.55	......
Martins	70	7	42.2	2.12	2.5
Monitor Mill	61	10	35.8	1.78	1.8
Palisade*1	61	22	35.9	2.78	5.5
Palmetto	70	7	38.4	0.30	3.0
Panaca	79	10	43.1	0.59	......
Reno State University	70	16	38.4	1.03	4.6
St. Clair	72	14	41.4	0.36	1.0
Silverpeak	78	14	45.0	......	......
Sodaville	78	15	44.8	0.17	1.5
Tecoma*1	65	20	33.7	0.25	2.5
Toano	......	......	......	1.80	13.0
Tuscarora	60	8	29.3	2.09	....
Tybo	64	......	......	0.59	......
Verdi*1	72	14	45.5	3.45	6.5
Wadsworth*1	62	20	38.6	0.70	2.5
Wells	61	9	33.4	3.43	......
New Hampshire.					
Alstead*6	47	4	27.1	6.87	36.5
Berlin Mills	54	—19	23.4	5.73	49.0
Bethlehem	56	— 7	25.8	5.61	46.0
Brookline*1	56	0	30.2	8.62	27.7
Claremont	56	0	29.4	5.56	31.5
Concord	56	0	28.0	5.88	38.1
Durham	58	9	29.2	4.81	21.5
Grafton	56	—16	23.2	5.06	42.0
Hanover	47	— 6	26.0	5.34	39.5
Keene	55	1	29.6	6.02	29.7
Littleton	50	— 6	23.8	4.98	38.4
Nashua	60	7	30.9	7.67	33.0
Newton	59	9	29.6	6.66	20.0
North Conway	54	— 3	26.6	5.60	44.0
Peterboro	51	— 2	26.7	7.09	41.6
Plymouth	47	— 5	24.4	5.70	36.5
Sanbornton	55	2	25.7	6.30	35.0
Stratford	49	—14	25.2	3.57	24.0
Warner	......	......	......	8.41	44.0
New Jersey.					
Asbury Park	59	18	38.8	7.72	4.8
Barnegat	55	27	39.4	4.98	3.0
Bayonne	70	19	38.6	6.55	5.0
Belvidere	62	14	35.3	5.24	4.0
Bergen Point	70	21	38.7	7.73	5.5
Beverly	73	19	40.0	6.91	4.5
Billingsport*1	70	23	39.4	6.71	0.5
Bridgeton	73	23	42.0	5.47	3.5
Camden	71	20	39.8	6.86	4.5
Cape May C. H.	67	22	41.6	5.07	5.0
Charlotteburg	65	13	34.6	7.58	7.0
Chester	64	13	34.1	7.47	11.5
Clayton	72	20	40.6	5.18	3.0
College Farm	71	17	38.9	6.63	7.0

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
New Jersey—Cont'd.	°	°	°	*Ins.*	*Ins.*
Deckertown	65	14	35.0	6.28	9.5
Dover	65	14	34.2	7.59	12.0
Egg Harbor City	69	18	39.6	5.42	4.0
Elizabeth	71	17	38.1	8.53	10.0
Englewood	64	19	35.8	6.72	5.0
Flemington	70	17	37.7	7.80	7.0
Freehold	69	18	38.3	6.80	4.0
Friesburg	72	22	41.0	5.16	2.0
Hammonton	......	......	......	5.63	6.5
Hanover	65	23	37.3	8.43	7.0
Hightstown	71	20	39.8	7.67	5.0
Imlaystown	72	19	40.7	5.95	6.3
Lebanon	......	......	......	9.58	7.5
Moorestown	71	19	39.4	7.33	4.0
Mount Pleasant	......	......	......	4.55	3.5
Newark	64	16	36.3	6.75	4.0
New Brunswick	70	18	39.8	6.82	5.0
Ocean City	60	24	39.2	5.19	T.
Oceanic	72	19	38.5	7.22	4.0
Paterson	68	19	38.6	7.49	12.5
Perth Amboy	70	18	39.4	6.67	4.0
Plainfield	69	17	37.2	7.23	4.5
Port Norris	73	23	41.8	5.61	T.
Rancocas	......	......	......	6.56	4.3
Rivervale	68	15	36.4	5.42	11.0
Roseland	68	16	35.7	7.27	6.0
Salem	72	22	41.6	5.94	3.5
Somerville	70	17	39.3	7.85	7.0
South Orange	68	18	36.6	6.97	5.5
Staffordville	......	......	......	6.77	4.0
Toms River	69	......	......	6.06	5.0
Trenton	65	21	40.8	8.86	4.0
Vineland	71	19	41.2	4.83	1 0
Woodbine	67	20	40.8	4.62	2.0
New Mexico.					
Albert	82	12	45.8	0.05	0.5
Albuquerque	76	21	48.6	0.40	4.0
Aztec	70	10	40.4	0.74	6.5
Bernalillo	80	19	48.0	0.30	2.0
Bluewater	71	8	38.5	0.40	1.0
Clayton	78	5	42.5	......	
East Lasvegas	76	0	43.8	0.70	8.2
Eddy	92	21	58.4	0.70	2.0
Engle	78	28	52.8	1.12	
Espanola	75	15	43.2	0.20	
Folsom	75	0	37.9	0.80	10.1
Fort Union	73	—10	37.8	0.95	9.0
Fort Wingate	69	10	39.6	0.07	0.8
Galisteo	71[b]	15[b]	45.5[b]	0.43	
Gallinas Spring	78	6	46.0	0.63	5.0
Gila	83	21	49.6	0.21	
Hillsboro	77	19	49.6	0.16	.....
Las Vegas Hotsprings	71	— 2	41.7	0.59	6.6
Los Lunas	76	18	47.6	0.25	
Lower Penasco	80	17	52.8	0.35	3.5
Mesilla Park	86	15	51.2	0.19	
Monero	64	5	33.9	1.62	.....
Puerto de Luna	79	— 5	48.4	1.00	10.0
Raton	65	10	38.4	0.40	4.0
Rincon	87	18	53.2	T.	
Roswell	89	19	52.4	0.06	T.
San Marcial	87	21	52.8	0.08	
Socorro	......	21	......	0.80	
Springer	75	— 3	41.2	0.70	7.0
White Oaks	73	15	45.4	0.80	8.0
Winsors Ranch	62	3	32.2	0.94	......
New York.					
Addison	62	10	33.3	2.24	10.5
Alfred	59	5	29.0	2.07	8.0
Angelica	63	5	32.2	2.72	13.0
Appleton	64	15	30.8	2.26	8.1
Arcade	65	6	29.2	2.41	13.2
Auburn	62	10	33.0	3.20	14.5
Avon	64	12	32.0	1.33	8.7
Baldwinsville	62	6	30.7	4.40	14.0
Bedford	59	10	34.6	5.58	10.6
Big Sandy *[10]	48	6	27.8		
Bolivar	63	1	31.2	2.81	11.0
Bouckville	53	6	27.0	4.80	14.0
Boyds Corners	......	......	......	7.56	18.0
Brentwood	64	6	35.6	8.70	......
Caldwell	48	0	27.9	6.02	39.5
Canajoharie	47	2	29.7	6.89	18.0
Canton	56	— 6	26.2	3.87	13.5
Carmel	55	10	33.6	7.02	16.0
Carvers Falls	47	4	27.8	5.19	19.0
Catskill	53	15	31.8	5.12	25.0
Cedarhill	54	7	31.2	4.24	19.6
Charlotte *[10]	64	20	33.9		
Cooperstown	52	0	27.3	6.04	36.0
Cortland	58	7	29.8	1.83	17.0
Cutchogue	55	19	35.4	8.50	3.0
Dryden	60	6	29.6		
Ellenburg Depot *[1]	52	0	25.3	4.14	41.1
Elmira	66	12	33.9	2.94	9.0
Fleming	59	11	30.9		

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
New York—Cont'd.	°	°	°	*Ins.*	*Ins.*
Fort Niagara	63	13	29.8	0.96	......
Franklinville	65	2	29.4	3.26	11.3
Glens Falls	48	8	29.7	5.72	21.5
Gloversville	46	— 3	26.7	7.19	38.5
Greenwich	53	1	29.2	6.13	29.5
Hemlock Lake	57	13	31.3	1.03	6.5
Honeymead Brook	54	11	30.8	6.45	25.0
Hopewell [4]	60	11	30.6	1.17	4.0
Humphrey	65	6	30.0	3.73	17.3
Ithaca	63	12	31.2	2.46	14.7
Jamestown	65	9	32.4	4.62	21.5
Keene Valley	50	— 4	26.7	3.38	24.2
Lake Placid	48	— 4	25.0	4.00	40.0
Liberty	52	10	29.4	1.22	12.0
Little Falls	50	3	25.4	3.12	31.0
Lockport	65	16	32.0	1.12	4.0
Lowville	48	— 1	25.7	5.11	31.0
Lyons	60	16	32.8	3.24	11.0
Madison Barracks	......	0	......	0.70	4.5
Middletown	59	13	32.0	7.17	22.0
Mohonk Lake [1]	49*	11	30.2	6.77	......
Mount Morris	69	10	35.2	1.40	12.0
New Lisbon	54	0	27.4	4.49	26.5
North Hammond	56	4	28.5	4.77	14.8
North Lake	48	—12	22.4	7.33	55.8
Number Four	48	— 9	23.8	5.45	53.3
Nunda	72	10	32.0	2.86	10.0
Ogdensburg	54	2	25.8	4.31	......
Oneonta	60	4	30.5	5.51	......
Oxford	54	3	30.6	5.44	26.9
Palermo	57	7	28.8	2.38	13.6
Penn Yan	62	10	32.1	2.33	13.5
Perry City	59	6	29.0	2.93	16.8
Plattsburg Barracks	48	— 6	23.8	2.65	15.3
Port Jervis	60	12	33.8	5.83	15.0
Poughkeepsie	57	9	32.2	......	......
Primrose	62	15	36.2	6.72	7.0
Red Hook *[1]	50	16	31.7	1.75	17.5
Richmondville	52	4	27.6	6.24	41.0
Ridgeway	64	15	30.4	2.50	8.4
Rome	51	8	26.8	6.84	......
Romulus	63	12	32.0	2.35	13.2
St. Johnsville	50	5	29.3	4.90	32.8
Saranac Lake	52	— 9	23.8	3.50	43.0
Saratoga Springs	47	5	29.0	5.60	28.8
Schenectady	55	11	31 3	4.34	25.2
Setauket	56	19	35.6	8.15	7.5
South Canisteo	59	4	30.4	2.60	12.8
Southeast Reservoir	......	......	......	6.46	......
South Kortright	54	— 3	28.2	3.53	......
Straits Corners	58	6	30.0	3.17	12.4
Ticonderoga	52	11	29.8	4.57	27.5
Victor	62	11	30.3	2.99	17.0
Wappingers Falls	59	12	34.0	7.61	32.0
Watertown	62	4	28.2	5.21	18.5
Waverly	53	2	30.9	2.88	7.8
Wedgwood	58	8	29.1	2.80	11.2
West Berne	60	10	29.8	6.43	38.0
Westfield *a*	68	15	32.6	2.98	12.5
Westfield *b*	67	8	31.8	......	......
Westpoint	60	22	37.0	7.45	......
Willetspoint	56	9	36.7	7.26	......
North Carolina.					
Abshers	75	8	46.4	10.06	T.
Asheville	......	......	......	9.04	1.5
Biltmore	76	4	47.8	8.64	2.0
Bryson City	......	......	......	12.77	0.5
Chapel Hill	74	15	49.6	6.79	
Currituck Inlet	......	......	......	4.52	T.
Durham	76	16	53.8	9.55	
Edenton	73	26	51.0	5.20	
Experimental Farm	72	16[c]	50.2	6.04	T.
Fairbluff	......	......	......	2.55	T.
Fayetteville	80	20	54.8	5.32	
Flatrock	72	5	46.2	11.01	T.
Greensboro	70	14	47.0	7.94	
Greenville	76	22	54.2	6.02	
Henderson	72	18	48.8	6.69	T.
Hendersonville	73	5	47.0	9.27	T.
Horse Cove	70	— 1	45.7	13.15	1.2
Lenoir *[1]	69	14	46.6	11.84	T.
Linville	64	— 4	39.8	11.89	5.0
Littleton	72	17	48.4	4.72	T.
Louisburg	74	20	50.6	5.35	T.
Lumberton	79	26	53.4	2.97	
Mana	......	......	......	10.24	2.0
Marion	75	9	47.2	12.68	0.5
Marshall	71	8	46.4	10.79	1.7
Mocksville	76	13	49.3	9.28	
Moncure	75	22	52.6	5.45	
Monroe	79	16	52.0	5.23	T.
Morganton	80	11	51.2	10.82	
Mountairy	71	11	45.8	9.62	1.0
Mount Pleasant	73	16	50.6	6.32	T.
Murphy	......	......	......	12.72	3.0
Newbern	80	24	56.2	2.22	

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
North Carolina—Cont'd.	°	°	°	*Ins.*	*Ins.*
Oakridge	73	12	47.2	9.64	1.0
Pantego	......	......	......	3.53	
Patterson *[1]	70	10	43.8	12.76	T.
Pittsboro	75	18	49.8	6.27	
Rockingham	79	20	53.4	6.24	T.
Roxboro	72	11	46.2	5.77	T.
Salem	74	12	48.6	9.25	
Salisbury	78	29	52.1	8.39	0.5
Saxon	75	12	48.4	9.86	0.5
Selma	77	18	52.2	6.50	
Settle	72	9	44.8	8.38	0.5
Sloan	81	24	55.4	3.80	T.
Soapstone Mount	74	16	48.8	6.44	
Southern Pines *a*	78	19	55.9	6.93	
Southern Pines *b*	78	16	55.8	6.09	
Southport	76	21	54.8	1.81	T.
Springhope *[1]	70	20	50.4	3.70	
Tarboro	77	20	52.8	5.79	
Waynesville	72	2	47.0	13.01	T.
Weldon *a*	73	21	48.1	5.11	T.
Weldon *b*	......	......	......	4.78	T.
North Dakota.					
Amenia	55[c]	—19[c]	11.8[c]	0.40	4.0
Ashley	49	—24	6.4	1.20	12.0
Berlin	54	—23	7.0	2.27	22.7
Bottineau	35	—24	1.0	1.15	11.5
Buxton	48	—25	7.7	0.88	8.8
Churches Ferry	39	—29	4.0	1.50	15.0
Coal Harbor	48	—21	6.2	0.82	8.0
Devils Lake	43	—25	5.5	1.11	11.1
Dickinson	46	—20	8.6	0.82	8.2
Dunseith	39	—19	6.0	1.40	14.0
Ellendale	54	—19	11.8	2.80	28.0
Fargo	53	—17	8.0	1.58	15.8
Forman	56	—21	9.8	0.36	3.6
Fort Berthold	72	—26	8.1	0.70	7.0
Fort Yates	50	—20	11.4	0.70	7.0
Fullerton [1]	55*	—23	8.0	2.99	29.9
Gallatin	51	—26	7.6	1.04	10.4
Glenullin	43	—20	4.6	0.60	6.0
Goetz	42	—21	7.0	0.72	7.2
Grafton	44	—22	7.0	1.48	14.8
Hamilton	42	—26	7.9	0.82	6.6
Jamestown	54	—23	11.2	0.60	6.0
Kelso	53	—21	8.6	0.60	6.0
Larimore	45	—22	6.1	0.90	9.0
McKinney	38	—25	2.1	1.05	11.6
Mayville	51	—17	11.2	0.57	5.7
Medora	52	—19	13.1	0.55	5.5
Melville	51	—25	8.0	0.12	1.2
Milton	35	—30	4.2	0.90	9.0
Minnewaukon	47	—26	5.4	0.65	6.5
Minot	45	—17	7.2	0.80	8.0
Minto	45[c]	—24	10.4[c]	......	......
Napoleon	50	23	7.6	1.30	13.0
New England City	52	—20	7.8	0.70	7.0
Oakdale	52	—13	10.0	0.55	5.5
Portal	42	—22	5.2	......	......
Power	55	—23	9.6	1.65	16.5
Sheyenne	47	—25	6.6	......	......
Steele	51	—21	6.6	0.70	7.0
Towner	41	—26	4.2	1.30	13.0
University	......	......	......	0.60	6.0
Wahpeton	......	—19	......	0.65	6.5
Washburn	60	—23	8.3	0.92	9.2
Willow City	45[c]	—27[c]	5.6[c]	......	......
Woodbridge	36	—30	4.6	0.11	1.1
Ohio.					
Akron	67	11	35.8	2.84	7.5
Annapolis [d]	67	12	36.8	2.74	11.0
Ashland	67	6	34.6	2.71	14.5
Ashtabula	68	13	33.2	4.90	14.5
Atwater	......	......	......	4.06	12.0
Bangorville	68	2	34.9	4.38	6.2
Bellefontaine	65	8	33.6	3.06	5.0
Bement	......	......	......	5.03	14.4
Benton Ridge	60	9	34.3	5.18	22.3
Bethany	67	0	36.2	5.76	.....
Binola	......	......	......	4.14	14.0
Bladensburg	69	2	37.0	2.38	4.4
Bloomingburg	65	5	37.7	3.74	4.0
Bowling Green	67	10	32.8	4.59	16.0
Bucyrus	60	8	34.6	......	......
Cambridge	70	2	38.4	4.59	10.0
Camp Dennison	70	5	41.8	5.54	0.7
Canal Dover	70	7	37.4	4.53	8.5
Canton	67	10	36.2	4.86	16.4
Cedarville	66	10	41.3	3.89	2.0
Celina	63	3	34.8	3.67	13.0
Circleville	72	8	40.4	4.64	6.0
Clarksville	69	5	40.4	6.12	1.4
Cleveland *a*	68	15	34.8	4.73	19.1
Cleveland *b*	68	13	33.5	3.53	11.0
Coalton	74	7	42.0	6.13	5.0
Colebrook	66	10	34.0	3.31	11.5
Dayton *a*	71	4	39.5	4.10	4.0

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Ohio—Cont'd.	°	°	°	*Ins.*	*Ins.*
Dayton *b*				4.17	4.9
Defiance	69	6	32.3	3.99	15.0
Delaware	69	8	37.8	4.50	8.9
Demos	66	9	37.9	4.69	10.0
Dupont	66	8	33.2	3.73	18.0
Elyria	68	7	30.2	4.92	
Findlay	68	8	34.0	4.57	15.5
Frankfort	70	6	40.9	5.32	2.5
Garrettsville	69	11	34.9	4.52	13.5
Granville	70	9	38.6	5.40	4.7
Gratiot	69	8	37.5	5.48	9.7
Greenfield	69	7	41.4	6.87	4.2
Greenhill	68	7	35.8	3.58	8.2
Greenspring	60	8	37.2	4.72	15.9
Greenville	65	4	36.0	3.84	5.0
Hackney	68	9	42.6	5.01	11.0
Hanging Rock	63	9	42.4	7.70	T.
Hillhouse	68	9	31.8	4.22	19.0
Hillsboro	72	5	42.8	5.75	0.5
Hiram	66	12	34.2	4.63	10.5
Hudson	67	6	34.4	4.05	
Jacksonboro	69	3	37.7	3.15	4.0
Kenton	70	7	37.5	4.90	11.5
Killbuck	68	7	36.7	4.51	7.0
Lancaster	72	8	40.0	5.67	6.5
Leipsic	65	7	33.3	4.62	14.8
Levering	67	2	35.4	4.86	4.0
Logan	75	8	42.4	4.48	5.0
Lordstown	68	9	34.0	3.89	12.0
McArthur	72	8	41.3	5.44	1.0
McConnelsville	72	9	39.6	5.22	9.5
Mansfield				5.55	10.0
Marietta	71	11	44.2	6.04	4.5
Marion	69	8	36.8	4.71	10.5
Medina	67	7	35.1	4.00	12.0
Milfordton	66	4	33.0	4.52	12.1
Milligan	72	4	40.8	4.34	7.0
Millport	68	10	36.2	4.60	
Montpelier	64	6	30.3	3.41	
Napoleon	67	4	32.4	4.39	15.8
Neapolis				3.67	9.5
New Alexandria	67	8	39.6	4.50	12.0
New Berlin	68	6	35.3	3.78	10.0
New Bremen	66	2	36.9		
New Holland	70	7	39.0	5.20	8.8
New Paris	60	1	36.4	4.21	2.5
New Richmond	71	4	42.2	6.59	T.
New Waterford	67	13	36.4	4.15	11.0
North Lewisburg	71	5	35.6	4.75	8.0
North Royalton	65	9	34.5	2.65	5.0
Norwalk	68	4	33.6	5.42	22.0
Oberlin	68	4	34.2	4.67	
Ohio State University	70	8	39.2	4.58	4.2
Orangeville	67	7	34.3	3.30	11.0
Ottawa	69	8	35.2	4.52	15.0
Pataskala	70	7	38.3	5.38	7.7
Perry				3.64	16.0
Philo	71	7	39.0	4.55	10.2
Plattsburg	68	5	38.2	4.63	4.0
Pomeroy	71	9	41.5	4.98	5.2
Portsmouth *a*				7.32	T.
Portsmouth *b*	76	8	45.4	7.31	1.1
Pulse				5.75	4.5
Richwood	70	6	38.0	4.75	11.0
Ridgeville Corners	66	5	31.6	4.41	22.0
Ripley	69	4	41.6	6.29	1.9
Rittman	60	5	35.6	3.37	5.5
Rockyridge	68	7	32.7	4.50	17.2
Rosewood	66	3	35.6	3.87	9.0
Seaman	70	4	43.3	5.69	
Shenandoah	66	4	33.3	4.02	9.7
Sidney	67	5	35.4	4.37	5.1
Sinking Spring	78	5	42.3	5.41	4.5
Somerset	70	14	38.8	4.76	7.1
Springboro				3.60	
Strongsville				4.50	7.5
Sylvania	51	4	30.6	4.01	20.0
Thurman	73	7	43.9	5.20	1.0
Tiffin	65	10	34.1	5.06	15.2
Upper Sandusky	65	5	35.9	4.48	16.0
Urbana	66	8	37.3	4.19	5.8
Vanceburg	73	8	42.8	7.52	1.2
Vanwert	68	5	35.6	4.76	16.0
Vermillion	66	7	33.8	5.86	26.0
Vickery	65	6	33.8	4.87	12.8
Walnut				4.93	4.2
Warren	68	13	35.8	2.92	11.1
Warsaw	72	2	38.5	4.96	9.2
Wauseon	66	6	32.2	5.47	24.3
Waverly	73	8	42.3	5.88	3.6
Waynesville	66	6	37.2	5.01	3.0
Wellington	67	6	35.1	4.84	17.0
Westerville	67	8	38.8	4.11	6.3
Willoughby				4.78	15.2
Wooster	67	9	35.0	3.95	6.0
Zanesville				4.58	9.0

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Oklahoma.	°	°	°	*Ins.*	*Ins.*
Arapaho	85	11	46.4	0.60	2.0
Beaver	83	10	42.7	0.49	3.0
Burnett	80	10	48.0	0.59	T.
Clifton	80	9	46.4	1.07	0.2
Edmond		4		0.57	
Fort Reno	83	13	46.7		
Fort Sill	83	15	48.3	0.04	
Guthrie	80	15	46.2	0.26	T.
Hennessey	82	11	45.6	1.40	4.0
Hopeton	84	10	43.2	1.85	7.0
Jefferson	83	9	43.0	1.58	5.0
Kingfisher	83	12	48.2	1.09	3.0
Mangum	87	10	46.2		
Newkirk	78	6	44.8	1.20	6.5
Norman	81	11	48.3	0.96	T.
Pawhuska	76	11	45.0	2.14	8.5
Perry	81	11	44.3	0.55	4.0
Prudence	83	10	44.1	1.57	8.8
Stillwater	79	15	47.1	1.03	1.9
Waukomis	82	11	46.0	0.78	2.5
Winnview	83	10[e]	45.9	1.42	5.2
Oregon.					
Albany *a*	62	28	44.0	5.54	T.
Albany *b*				5.74	
Arlington	64	28	44.7	0.23	T.
Ashland *b*	63	28	43.4	3.54	2.5
Aurora *1	60	30		3.58	
Aurora (near)	61	25	43.2	3.40	T.
Bandon	60	32	45.7	6.91	T.
Bay City	57	28	42.6	6.06	0.5
Beulah	55	15	35.4	1.47	T.
Blalock	64	31	46.9	0.80	
Brownsville *1	57	30	42.8		
Burns	50	14	33.1	0.61	6.0
Burns (near)	66	18	37.9	1.34	T.
Cascade Locks	64	30	44.0	6.85	
Comstock *1	68	34	44.4		
Coquille River				6.62	T.
Corvallis	64	26	43.4	5.16	T.
Dayville	65	21	40.6	2.20	6.5
Ella				0.29	1.0
Eugene	60	29	43.4	5.57	3.0
Fairview	56	29	43.1	10.35	6.0
Falls City	61	29	42.6	6.60	1.2
Forestgrove	62	24	41.4	3.58	2.5
Gardiner	62	31	46.2	7.23	
Glenora	65	25	42.0	12.57	3.0
Government Camp	51	12	30.2	13.28	109.0
Grants Pass	68	28	45.6	4.82	
Happy Valley	65	13	34.8	2.79	13.0
Heppner	63	22	40.0	2.30	5.5
Hood River (near)	61	26	41.8	4.04	4.0
Jacksonville	61	27	43.4	4.05	
Joseph	49	6	30.2	1.80	18.0
Kerby	71	25	44.8	9.55	
Klamath Falls	63	18	38.6	3.43	12.0
Lafayette *1	62	32	43.4	4.50	
Lagrande	54	16	37.8	2.25	
Lakeview	56[e]	11[e]	33.2[e]	2.25	13.3
Langlois	70	31	48.2	11.55	
McMinnville	62	27	43.6	3.39	T.
Merlin *1	64	28		6.98	
Monmouth *a* *1	60	33	45.0		
Monmouth *b*	62	28	44.0	4.01	T.
Monroe	60	27	43.3	6.16	5.0
Mount Angel	61	28	43.5	5.01	T.
Nehalem				6.39	
Newberg	62	26[d]	43.5	3.20	T.
Newbridge	60	19	40.0	0.45	
Newport	59	31	44.6	4.90	
Pendleton	64	20	43.5	1.80	4.0
Placer				6.82	2.0
Prineville	59	16	37.1	0.82	
Riddles *1	65	31	44.2	5.12	
Riverside	61	16	38.7	1.95	
Salem *b*	68	25	44.2	4.13	
Sheridan *1	63	32	42.8		
Silver Lake	63	10	33.6	2.57	5.1
Silverton *1	62	34	44.2	4.87	
Siskiyou *1	64	20	43.0	0.70	7.0
Sparta	47	15	31.9	3.10	25.0
Springfield *1	57	32	43.4		
Stafford	62	27	43.0	4.22	
The Dalles	66	28	44.1	0.94	1.0
Tillamook Rock				2.56	
Toledo	66	25	45.2	7.20	
Umatilla				0.35	
Vale	60	19	39.7	0.79	
Vernonia	75	24	41.8	5.18	10.5
West Fork *1	60	29	43.3		
Weston	64	22	40.0	3.27	7.1
Williams	69	26	44.4	5.18	
Pennsylvania.					
Altoona	66	13	35.3	4.79	
Aqueduct	75	21	39.6	3.87	2.2

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Pennsylvania—Cont'd.	°	°	°	*Ins.*	*Ins.*
Athens	63	11	32.5	2.75	8.0
Beaver Dam				3.76	3.6
Bethlehem				4.06	
Brookville				3.73	6.3
Browers Lock				6.65	
Butler	67	10	36.2	5.29	21.5
Cameron				3.84	8.0
Carlisle	72	20	38.4	3.89	
Cassandra	63	13	35.7	4.61	12.0
Cedarrun				4.48	5.9
Centerhall	62	12	34.2	4.42	4.5
Chambersburg				4.23	
Coatesville	71	19	40.1	7.66	8.0
Confluence	75	8	38.4	6.13	5.0
Coopersburg	67	19	39.2	6.82	7.2
Davis Island Dam				3.85	3.7
Derry Station	72	11	38.9	4.91	7.5
Doylestown				6.07	
Driftwood				3.60	
Duncannon				4.06	
Dushore	60	7	31.9	3.79	6.2
Dyberry	54	7	30.4	5.14	24.3
East Mauch Chunk	69	13	35.6	3.75	9.2
Easton	65	17	37.5	4.41	4.0
Ellwood Junction				3.81	5.9
Emporium	66	10	34.8	4.69	12.5
Everett	73[d]	14[d]	38.1[d]	4.27	4.5
Farrandsville				4.26	9.0
Forks of Neshaminy *1	64	20	38.6	7.73	
Franklin	71	8	35.0	4.19	13.0
Frederick				6.14	
Freeport				5.84	13.7
Girardville				4.85	12.2
Grampian	64	12	32.7	4.42	12.0
Greensboro	70	10	43.6	5.47	6.0
Hamburg	65[k]	21[k]	37.6[k]	6.69	8.0
Hawley	60	6	32.2	4.28	
Hawthorn	70	11	36.6	10.30	9.0
Hews Island Dam				3.84	0.5
Huntingdon *a*	71	19	37.8	5.13	6.5
Huntingdon *b*				4.55	3.9
Irwin				4.22	4.0
Johnstown	73	13	39.8	5.37	3.9
Karthaus				3.68	10.0
Kennett Square	71	20	39.6	6.65	3.0
Lansdale				5.93	
Lawrenceville	62	5	32.6	2.28	7.5
Lebanon	70	18	37.6	5.21	6.0
Leroy	60	7	31.0	3.02	8.5
Lewisburg	69	16	36.1	4.36	6.8
Lock Haven *a*	68	14	37.6	3.79	6.0
Lock Haven *b*				3.27	3.0
Lock No. 4				4.91	6.0
Lycippus	70	8	38.0	4.62	6.2
Mifflin				5.00	8.0
Nisbet				3.23	
Oil City				4.63	9.3
Ottsville				5.56	
Parker				3.92	10.6
Philadelphia	70	22	40.8	7.12	4.1
Quakertown	67	18	37.2	7.14	8.5
Reading[2]			38.0	5.67	
Reedsville	59	11	35.2	5.87	2.0
Renovo *a*				2.80	4.0
Renovo *b*	65	13	36.4	3.97	5.6
Ridgway				4.03	10.0
Saegerstown	68	5	34.5	3.63	16.8
St. Marys				3.13	
Salem Corners	57	8	30.6	4.72	22.7
Scranton	65	11	34.5	4.46	9.0
Seisholtzville				6.06	
Selinsgrove *a*	71	16	38.2	4.58	4.8
Selinsgrove *b*				3.90	
Shawmont				6.37	
Shinglehouse		7		1.91	4.0
Sinnamahoning				2.34	6.1
Smethport	67	3	32.2	3.60	9.0
Smiths Corners				6.82	
Somerset	68	5	35.4	5.76	6.7
South Bethlehem	62	22	37.8		
South Eaton	63	12	33.3	3.96	14.0
State College	64	13	34.4	4.23	5.9
Sunbury				1.96	4.0
Swarthmore	67	22	39.8	6.50	
Towanda	53	12	33.8	2.55	6.5
Trout Run				6.19	6.5
Uniontown	68	11	40.2	5.67	14.0
Warren	55	4	31.6	4.35	13.8
Wellsboro	60	10	33.4	2.75	9.5
West Chester	69	19	38.8	7.38	4.5
West Newton				4.94	4.0
Westtown	73	20	38.0		
White Haven	62	17	32.8	4.12	9.0
Wilkesbarre	66	15	35.5	4.49	7.0
Williamsport	65	16	36.0	4.36	4.0
York	72	22	38.9	5.16	3.2

TABLE II.—*Climatological record of voluntary and other cooperating observers*—**Continued.**

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Rhode Island.	°	°	°	*Ins.*	*Ins.*
Bristol	50	18	35.2	7.06	5.0
Kingston	54	15	33.6	9.67	7.2
Lonsdale	.....	.....	.....	7.76	9.5
Pawtucket	59	21	36.9	7.69	8.0
Providence *a*	60	18	45.7	8.38	7.5
Providence *c*	60	15	33.9	8.19	7.5
South Carolina.					
Allendale	82	22	56.8	2.05	
Anderson	.....	.....	.....	6.82	
Batesburg	81	20	54.7	6.47	T.
Beaufort	82	26	60.8	1.51	T.
Blackville	84	19	56.9	2.04	T.
Calhoun Falls	.....	.....	.....	3.97	
Camden	.....	.....	.....	4.23	T.
Central	79	13	52.2	9.10	T.
Cheraw *a*	80	21	54.1	4.84	.....
Cheraw *b*	.....	.....	.....	5.18	T.
Clemson College	79	14	52.2	8.02	T.
Conway	.....	.....	.....	2.01	T.
Darlington	.....	.....	.....	3.95	
Edisto	.....	.....	.....	2.17	T.
Effingham	.....	.....	.....	3.21	T.
Florence	82	20	57.3	2.41	
Gaffney	.....	.....	.....	5.90	0.2
Georgetown	80	24	54.8	2.75	
Gillisonville	85	19	60.8	1.61	T.
Greenville	78	14	48.7	7.51	1.0
Greenwood	80	16	52.2	4.26	T.
Holland	80	13	51.3	5.38	2.0
Kingstree *a*	83	24	57.1	2.19	T.
Kingstree *b*	.....	.....	.....	2.21	T.
Little Mountain	82	17	55.2	4.19	
Longshore	81	18	53.2	3.86	T.
Pinopolis *[1]	78	26	57.6	1.65	
St. Georges	81	22	56.6	2.30	T.
St. Matthews	85	21	55.2	2.23	T.
St. Stephens	.....	.....	.....	1.91	T.
Santuck	76	15	52.8	5.70	T.
Shaws Fork	80	18	54.8	3.78	
Smiths Mills	.....	.....	.....	2.68	T.
Society Hill	79	23	55.6	3.00	
Spartanburg	75	13	48.8	6.25	
Statesburg	83	21	58.0	3.50	
Summerville	83	22	59.0	2.26	T.
Temperance	89	21	54.8	3.19	
Trenton	81	21	57.3	5.31	T.
Trial	84	20	56.1	2.01	
Walhalla	78	12	49.9	8.55	0.5
Winnsboro	77	16	52.9	5.51	1.6
Yemassee	84	21	58.8	2.38	T.
Yorkville	77	18	53.6	5.76	T.
South Dakota.					
Aberdeen	51	−21	11.6	1.85	18.5
Alexandria	66	−16	17.6	1.63	12.0
Armour	63	−13	21.8	1.20	12.0
Ashcroft	56	−18	16.6	1.55	15.5
Bowdle	.....	−25	.....	1.55	15.5
Canton	51	.....	.....	0.95	11.1
Centerville	.....	.....	.....	1.19	11.5
Chamberlain	54	−16	18.2	2.18	17.0
Chandler	63	− 9	18.1	2.06	16.4
Clark	.....	.....	.....	0.32	3.2
Desmet	55	−14	15.8	0.95	5.0
Doland	60	−17	15.5	1.02	4.0
Elkpoint	51	− 7	21.8	0.76	10.0
Farmingdale	.....	.....	.....	1.60	16.0
Flandreau	56	−15	17.3	1.13	6.6
Forestburg	64	−18	17.2	0.72	6.2
Forest City	54	−15	14.0	3.00	30.0
Fort Meade	.....	0	.....	1.42	14.2
Gann Valley	.....	.....	.....	1.70	17.0
Gary	.....	−14	.....	0.95	9.0
Goudyville	57	−20	12.2	2.30	15.0
Harney	58	−21	19.5	1.31	16.0
Highmore	50	−16	15.0	1.50	15.0
Hotch City	59	−16	18.6	1.19	10.9
Hot Springs	58	− 9	21.8	2.05	22.0
Howard	54	−12	19.4	0.80	8.0
Interior	51	.....	.....	1.40	14.0
Ipswich	55	−18	11.0	1.20	12.0
Kimball	63	−11	18.4	1.75	14.7
Leslie	59	−21	16.6	0.86	.....
Mellette	58	−20	13.3	1.60	16.0
Menno	62	−11	17.6	1.10	8.6
Millbank	54	−12	14.4	0.67	6.7
Mitchell	67	−16	18.0	1.29	11.5
Montrose	56	−12	16.2	0.70	6.0
Nowlin	.....	.....	.....	2.00	20.0
Oelrichs	58	− 9	20.1	2.80	28.0
Parker	55	−10	18.6	0.80	8.0
Plankinton	62	−14	16.2	1.48	8.5
Redfield	61	−21	14.5	0.59	12.8
Rochford	58	−12	21.7	1.75	17.5
Rosebud	62	−13	21.3	1.90	19.0
Silver City	.....	.....	.....	2.35	23.5
Sioux Falls	57	−13	16.8	1.33	11.7

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum	Mean.	Rain and melted snow.	Total depth of snow.
South Dakota—Cont'd.	°	°	°	*Ins.*	*Ins.*
Spearfish	58	− 6	20.3	2.04	20.6
Tyndall	62	−11	19.8	0.62	6.2
Watertown	55	−16	14.7	0.30	3.0
Waubay	53	−18	11.2	2.58	6.8
Wentworth	56	−12	17.0	0.71	7.2
Wessington Springs	55	−16	14.0	1.90	19.0
Whiteswan	66	− 6	21.8	1.13	6.8
Wolsey	.....	.....	.....	1.65	12.5
Tennessee.					
Andersonville	75	2	46.6	10.45	1.5
Ashwood	76	3	48.2	7.29	3.0
Benton (near)	78	1	50.6	17.06	
Bluff City	.....	.....	.....	7.90	1.0
Bristol	71	3	43.5	9.01	2.0
Byrdstown	75	− 1	47.6	10.39	4.5
Carthage	78	3	49.8	8.58	1.5
Charleston	.....	.....	.....	13.70	0.5
Clarksville	78	4	47.0	7.75	4.5
Clinton	.....	.....	.....	11.73	1.0
Decatur	77	2	49.6	12.17	2.0
Dover	78	4	47.6	6.95	2.0
Elizabethton	74	4	46.8	10.72	0.2
Elk Valley	71	1	42.6	10.21	T.
Erasmus	75	− 3	45.8	8.56	7.1
Florence	76	3	48.6	6.82	3.5
Franklin	79	4	48.4	7.31	3.0
Grace *[1]	70	4	47.9	6.60	1.0
Greeneville	75	3	47.1	10.51	1.4
Harriman	76	3	48.0	9.16	1.5
Hohenwald	75[f]	1	49.3[c]	9.15	3.6
Jackson	78	10	49.5	6.25	
Johnsonville	79[d]	4[d]	49.2[d]	6.02	1.0
Jonesboro *[1]	67	8	46.2	11.01	2.7
Kingston	.....	.....	.....	8.80	T.
Lafayette *[5]	74	0	44.8	11.75	6.0
Lewisburg *[1]	74	4	48.1	6.40	2.7
Liberty	75	2	47.7	6.22	0.5
Lynnville	74	4	47.6	6.45	1.0
McMinnville	72	1	48.4	8.35	0.2
Madison	85	2	48.4	9.13	5.5
Maryville *[5]	75	5	49.4	13.78	1.3
Newport	79	6	48.2	11.88	2.5
Nunnelly	77	2	48.2	7.28	3.5
Oak Hill	77	− 1	49.2	13.29	2.4
Palmetto	79	1	50.2	5.45	3.0
Peryear *[5]	76	10	47.6	4.40	.....
Pope	78	6	48.8	7.82	4.1
Rogersville	70	7	46.4	9.07	0.5
Rugby	72	− 2	45.6	7.95	0.5
St. Joseph	77	3	50.0	7.29	1.3
Savannah	77	6	50.2	7.28	1.3
Sewanee	72	4	46.2	7.10	1.5
Silverlake	66	− 8	42.9	10.77	3.5
Springdale	76	3	47.4	10.47	1.0
Springfield	79	3	46.7	8.80	2.0
Sylvia	79[g]	1[g]	47.9[g]	7.68	5.5
Tazewell	.....	.....	.....	10.34	0.5
Tellico Plains	79	3	52.2	11.09	0.5
Tracy City	75	− 4	46.6	10.30	2.2
Trenton	78	9	49.2	4.77	0.7
Tullahoma	78	0	49.4	8.50	3.0
Union City	74	8	45.6	3.20	.....
Waynesboro	75	3	49.5	7.47	2.1
Wildersville	76	6	49.6	6.96	3.0
Yukon	77	2	50.4	9.70	
Texas.					
Albany *[1]	87	24	56.5	T.	
Alvin	.....	.....	.....	0.84	
Anna	94	14	56.0	0.50	
Anson	.....	.....	.....	T.	T.
Arthur	.....	.....	.....	0.41	
Austin *a*	95	29	59.8	0.00	
Austin *b* *[5]	94	28	59.8	.....	
Beaumont	82	36	59.9	T.	
Beeville	98	32	66.1	0.55	
Blanco	96	30	62.6	0.00	
Boerne *[1]	97	28	61.7	0.03	
Brazoria	81	36	63.7	0.41	
Breckenridge [c]	92	22	56.9	0.44	
Brenham	92	31	64.2	2.25	
Brighton	91	40	66.0	0.04	
Brownwood	93	22	56.6	0.80	
Burnet *[1]	98	28	59.6	T.	
Camp Eagle Pass	.....	30	.....	0.00	
Coleman	96	22	57.0	0.54	T.
Colorado	.....	.....	.....	T.	
Columbia	87	34	63.9	0.20	
Conroe	87	30	63.1	2.34	
Corsicana	94	28	58.6	0.38	
Cuero	92	32	63.8	1.37	
Danevang	90	31	64.7	0.41	
Dublin	96	21	56.2	0.03	
Duval	102	28	65.7	0.17	
Emory	92	32[k]	60.0[e]	0.58	
Estelle	99	20	58.8	0.31	T.
Fort Brown	98	45	71.8	0.13	

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Texas—Cont'd	°	°	°	*Ins.*	*Ins.*
Fort McIntosh	103	36	70.2	0.30	
Fort Ringgold	105	37	73.6	0.18	
Fort Stockton	.....	.....	.....	0.00	
Fredericksburg *[1]	100[c]	27[c]	61.0[c]	T.	
Fruitland	91	19	54.5	0.12	
Gainesville	87[d]	19	52.2	T.	
Georgetown *[1]	99	26	60.4[d]	0.23	
Golindo	.....	.....	.....	0.35	
Hale Center	88	13	52.5	0.15	1.5
Hallettsville	90	32	65.0	1.38	
Hewitt	.....	.....	.....	T.	
Honeygrove	.....	.....	.....	0.79	
Houston	88	36	64.0	0.27	
Hulen	85	32	64.6	0.41	
Huntsville	85	30	61.8	2.35	
Jacksonville	89	26	61.0	2.02	
Jasper	88	32	61.3	1.34	
Kent	.....	.....	.....	0.02	T.
Kerrville	102	23	60.2	T.	
Lampasas	102	20	61.3	0.05	
Langtry	92	31	62.2	0.00	
Llano *[5]	107	32	62.8	0.00	
Longview	89	26	58.0	1.64	
Luling	95	30	64.0	0.55	
Marshall	83	25	57.9	2.04	
Mount Blanco	87	15	50.0	0.00	
New Braunfels	94	32	65.0	0.00	
Panter	.....	.....	.....	0.58	
Point Isabel *[1]	87	54	70.8	0.05	
Rhineland	90	18	54.1	0.23	
Roby	95[g]	18[g]	54.8[g]	0.28	
Rock Island	.....	.....	.....	1.00	
Rockport *[1]	71	32	58.4	.....	
Runge	97	33	67.6	0.58	
Sabine Pass	84	39	64.5	0.04	
San Antonio	98	32	67.0	0.07	
San Marcos *b*	95	29	62.4	0.00	
Sherman	85	26	54.6	0.44	
Sugarland	90	31	65.4	0.32	
Sulphur Springs	90	23	57.2	0.76	
Temple *a*	100	27	60.1	0.15	
Topaz	98[b]	22[c]	59.1[c]	0.28	
Tulia	89	− 1	46.4	0.30	3.0
Tyler	89	26	56.2	1.45	
Valentine	84	26	58.4	0.00	
Victoria	.....	.....	.....	0.78	
Waco	99	27	59.8	0.00	
Waxahachie	99	19	59.6	0.10	
Weatherford	94	22	56.8	0.29	
Wichita Falls	.....	.....	.....	0.33	
Utah.					
Alpine	.....	.....	.....	1.59	.....
Brigham	.....	.....	.....	3.16	18.0
Castledale	68	9	39.2	0.38	.....
Cisco	76	9	40.3	0.20	2.0
Corinne	67	15	34.6	1.30	4.0
Croydon	63	4	34.1	1.15	11.5
Fillmore	75	4	40.2	5.00	.....
Fort Duchesne	75	8	35.4	2.10	1.0
Frisco	69	16	41.4	2.56	8.8
Giles	82	10	45.3	0.56	
Grover	70	4	38.4	0.21	2.0
Heber	56	6	33.5	3.00	.....
Huntsville	.....	.....	.....	4.39	17.0
Levan	66	2	37.9	3.96	19.5
Loa	68	0	34.2	0.29	0.8
Logan	54	14	35.0	1.79	.....
Manti	74	15	39.2	.....	.....
Marysvale	.....	.....	.....	4.29	31.0
Millville	.....	.....	.....	2.55	.....
Minersville	71	9	40.4	2.40	4.0
Moab	81	19	49.2	0.57	1.3
Mount Pleasant	67	8	36.6	2.29	18.0
Pahreah	73	14	45.8	0.25	
Parowan	72	1	39.2	2.18	21.5
Pinto	66	− 1	35.2	2.17	6.5
Provo	73	20	42.4	2.45	.....
Richfield	72	22	44.9	4.65	1.5
St. George	84	15	48.1	0.29	
Scipio	72	6	39.0	3.95	13.0
Snowville	52	14	34.7	1.65	4.0
Soldier Summit	66	5	33.6	1.40	14.0
Thistle	62	10	34.6	1.30	13.0
Tooele	67	16	39.6	2.88	.....
Tropic	71	10	36.2	0.10	1.0
Vernal	64	2	36.3	1.93	6.4
Woodruff	50	− 3	26.0	2.02	14.0
Vermont.					
Bennington	58	4	30.8	4.71	27.8
Brattleboro	49	7	29.7	7.95	49.4
Burlington	48	2	29.1	4.12	31.0
Chelsea	51	− 5	24.6	4.66	43.0
Cornwall	48	2	28.0	3.45	20.0
Derby	50	−14	23.4	3.95	36.0
Enosburg Falls	55	− 8	27.7	6.40	49.0
Hartland	45	− 7	24.8	6.42	44.0

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
	°	°	°	Ins.	Ins.
Vermont—Cont'd.					
Jacksonville	52	0	26.2	9.00	49.7
Norwich	46	− 5	24.5	6.39	39.0
St. Johnsbury	49	− 9	24.8	5.33	33.8
Vernon *[8]	47	7	30.2	7.22	32.0
Wells	50	1	26.6	5.63	35.2
Woodstock	44	− 6	24.2	6.96	45.0
Virginia.					
Alexandria	68	20	42.6	5.68	3.5
Ashland	74	18	46.2	5.82	13.0
Bedford City	73	10	46.0	......	......
Bigstone Gap	72	3	47.0	11.50	1.0
Birdsnest *[1]	74	26	46.2	5.50	3.0
Blacksburg	70	3	41.9	6.50	4.0
Buckingham	60	15	37.2	8.05	......
Burkes Garden	62	8	41.1	10.09	5.0
Callaville	72	17	48.6	6.88	1.0
Charlottesville	73	10	44.3	5.72	5.0
Christiansburg	......	......	......	7.11	......
Clarksville	......	......	......	5.23	......
Clifton Forge	67	12	43.0	3.70	2.0
Colemans Falls	72	11	47.0	8.76	1.0
Dale Enterprise	70	8	41.3	4.34	4.0
Danville	......	......	......	7.02	......
Doswell	70	14	45.1	4.90	1.4
Dwale	......	......	......	5.96	T.
Farmville	75	17	47.2	9.72	4.0
Fredericksburg	74	18	44.4	5.41	6.0
Grahams Forge	65[d]	4[d]	43.0[d]	5.96	1.0
Hampton	70	21	48.0	5.91	1.0
Hot Springs	69	5	40.8	6.50	8.0
Leesburg	......	......	......	5.30	1.0
Lexington	73	12	43.9	6.69	3.8
Manassas	70	17	43.2	......	......
Marion	68[d]	4[d]	44.2[d]	8.34	1.0
Miller School	72	15	46.0	6.64	5.0
Monterey	64	2	36.1	3.70	8.0
Newport News	72	22	49.0	6.94	T.
Petersburg	75	17	48.1	5.93	3.0
Quantico	72	10	41.0	......	......
Radford	......	......	......	5.35	1.0
Richmond (near)	75	18	47.6	6.28	11.0
Rockymount	70	10	46.6	9.39	1.0
Salem	75	12	45.4	5.87	1.5
Speers Ferry	......	......	......	8.72	T.
Spottsville	72	18	47.3	6.51	3.0
Stanardsville	72	16	43.8	6.25	3.5
Staunton	74	12	44.6	6.15	6.0
Stephens City	77	13	41.4	4.94	2.0
Sunbeam	74	18	50.3	7.22	1.0
Tobaccoville	70	15	43.7	6.18	9.0
Warrenton	70	20	42.8	4.21	2.0
Warsaw	73	17	44.6	3.82	1.5
Westbrook	74	20	45.8	......	......
Westpoint	74	18	45.0	5.60	6.0
Williamsburg	78	23	46.8	......	......
Woodstock	74	16	42.6	3.47	3.4
Wytheville	68	3	43.2	7.23	1.0
Washington.					
Aberdeen	59[e]	27[d]	42.3[e]	4.65	0.2
Anacortes	......	......	......	2.35	2.0
Ashford	......	......	......	5.21	22.0
Blaine	58	15	36.4	2.64	6.0
Bridgeport	77	12	42.4	0.00	
Brinnon	55	30	41.7	4.56	3.5
Cedar Lake	......	......	......	8.92	45.5
Cedonia	48	− 2	29.2	0.50	7.4
Centerville	66	20	39.1	0.52	2.0
Chehalis	62	25	43.5	1.54	
Clearwater	......	27	......	6.80	
Cle Elum	57	15	36.2	5.86	27.8
Colfax	69	22	42.2	1.94	4.0
Coupeville	60	25	41.6	2.16	2.8
Dayton	59	23	40.8	2.14	1.0
Ellensburg	61	19	38.5	0.18	1.3
Ellensburg (near)	66	20	38.2	0.30	3.0
Fort Simcoe	62	24	41.6	0.22	T.
Grandmound	61	21	42.8	3.69	0.1
Hooper	62	25	41.6	0.45	T.
Kennewick	67	22	45.4	0.25	
Lacenter	60	27	42.0	3.40	0.2
Lakeside	60	24	40.2	0.12	
Lind	62	19	39.6	0.27	1.6
Loomis	57	18	37.5	0.80	T.
Mayfield	68	24	42.5	5.35	3.0
Montecristo	50	17	34.3	8.40	99.0
Moxee Valley	68	16	41.7	T.	T.
New Whatcom	63	26	43.0	1.58	3.0
Northbend	56[1]	24[1]	40.9[1]	6.62	1.5
Olga	54	29	41.8	2.17	3.5
Olympia	61	25	43.2	3.37	T.
Orcas Island	60	29	43.2	1.90	
Pinehill	60	26	41.6	1.63	0.5
Pomeroy	55	29	39.8	2.15	2.7
Port Townsend	54	31	42.6	1.61	T.
Pullman	52	15	36.0	2.05	8.0
Rosalia	50	20	36.2	0.87	4.8

Stations	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
	°	°	°	Ins.	Ins.
Washington—Cont'd.					
Sedro	66	29	42.4	2.11	......
Shoalwater Bay *[10]	56	33	43.7	......	......
Silvana	57	23	40.1	2.95	
Snohomish	60	26	42.6	3.08	4.0
Snoqualmie	58	28	43.6	4.00	......
Southbend	60	26	42.8	5.59	
Stampede	56	17	34.4	8.03	75.5
Sunnyside	64	19	42.6	T.	
Union City	60	26	42.6	4.29	0.5
Vancouver	63	26	44.0	2.46	
Vashon	58	29	42.4	1.95	
Waterville	57	12	34.2	0.05	0.5
Wilbur	47	8	29.4	0.50	5.0
West Virginia.					
Beverly	76	7	42.0	5.71	11.0
Bluefield	69	0	43.7	6.27	3.8
Buckhannon *a*	......	......	......	5.96	12.0
Buckhannon *b*	72	6	41.8	......	......
Burlington	76	13	39.6	4.50	3.0
Charleston	......	......	......	7.41	1.0
Dayton	74	7	43.4	5.59	3.5
Eastbank	70	10	46.6	7.74	2.0
Elkhorn	72	4	45.0	7.34	2.1
Fairmont	......	......	......	5.67	5.7
Glenville	72	9	43.4	7.80	12.2
Grafton	72	7	42.6	5.51	5.0
Green Sulphur	71	5	43.4	6.15	4.0
Hamlin	......	......	......	6.80	T.
Harpers Ferry	......	......	......	4.48	0.5
Hinton *a*	......	......	......	7.05	5.0
Hinton *b*	72	7	44.8	......	......
Huntington	70	9	42.8	7.92	4.0
Kingwood	72	4	40.5	7.23	......
Marlinton	68	6	39.8	6.28	3.0
Martinsburg	76	16	39.5	4.15	2.0
Morgantown	74	10	41.6	6.63	3.8
New Cumberland	71	12	40.6	3.54	10.0
New Martinsville	71	11	43.8	5.70	9.5
Nuttallburg	76	2	45.0	8.00	8.0
Oldfields	71	11	40.9	3.01	0.2
Parsons	73	7	42.7	......	......
Philippi	73	8	44.7	5.37	9.0
Point Pleasant	74	8	45.0	6.54	1.0
Powellton	65	1	41.6	8.48	4.2
Romney	72	14	40.7	3.35	0.5
Rowlesburg	......	......	......	6.78	12.0
Upper Tract	75	9	43.4	2.40	T.
Weston *a*	......	......	......	6.53	12.0
Weston *b*	75	7	46.2	......	9.0
Wheeling *a*	......	......	......	4.76	10.1
Wheeling *b*	73	12	44.1	4.81	8.0
Wisconsin.					
Amherst	40	−14	17.0	2.50	22.0
Antigo	37	−15	17.2	1.70	17.0
Barron	38	−26	13.2	3.30	33.0
Bayfield	34	−20	13.4	1.40	14.0
Beloit	57	0	27.6	0.28	4.0
Brodhead	58	− 3	26.6	1.57	7.5
Butternut	50	−27	15.2	2.01	20.1
Chilton	45	− 4	22.1	1.20	9.0
Citypoint	40	− 6	22.4	......	......
Delavan [f]	60	− 2	27.0	0.71	7.3
Dodgeville	54	−10	23.2	2.68	......
Easton	50	−15	18.9	1.81	15.2
Eau Claire	36	−15	17.7	2.90	18.0
Florence	36	−11	15.0	3.66	13.5
Fond du Lac	51	− 3	22.8	1.56	11.6
Grand River Locks	......	......	......	2.52	15.5
Grantsburg	49	−23	13.9	2.56	23.0
Hartford	51	− 3	24.4	2.50	17.5
Hartland	57	− 2	24.0	2.01	16.5
Harvey	55	− 3	24.8	1.82	11.2
Hayward	40	−25	14.6	2.44	20.9
Heafford Junction	37	−22	13.4	2.94	15.0
Hillsboro	51	−17	19.0	3.28	24.0
Knapp	37	−20	15.9	1.10	11.0
Koepenick *[1]	36	−10	18.3	2.50	25.0
Lancaster	52	−10	22.0	1.61	11.5
Madison	51	− 4	22.8	1.94	13.5
Manitowoc	41	1	22.4	1.84	9.5
Meadow Valley	40	−13	17.7	1.84	11.5
Medford	39	−22	14.6	1.75	13.0
Menasha	......	......	......	1.79	12.0
Neillsville	38	−17	18.2	2.41	......
New Holstein	44	− 2	19.6	2.25	9.0
New London	41	− 7	19.4	2.88	22.0
Oconto	45	− 3[g]	22.4[d]	2.22	13.0
Osceola	38	−25	13.8	2.19	27.5
Oshkosh	43	− 4	21.3	1.45	......
Pepin	36	−15	18.0	2.93	14.0
Pine River	40	−10	20.0	2.35	13.7
Portage	49	− 6	22.2	1.94	17.0
Port Washington	45	− 4	24.4	2.45	17.0
Prairie du Chien	43	−12	24.6	2 12	11.5
Prentice *[1]	40	−16	14.6	1.73	16.8
Racine	60	2	27.4	1.69	......

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
	°	°	°	Ins.	Ins.
Wisconsin—Cont'd.					
Sharon	60	− 4	24.9	1.65	6.0
Shawano	39	− 7	18.8	2.32	17.0
Spooner	40	−20	15.3	5.20	52.0
Stevens Point	42[e]	−17[e]	18.2[e]	1.15	6.0
Sturgeon Bay Canal *[9]	40	− 4	22.2	......	......
Valley Junction	40	−13	18.6	2.63	18.5
Viroqua	45	−10	20.9	2.63	20.2
Watertown	55	− 3	23.0	2.36	20.0
Waukesha	56	− 3	24.0	1.47	12.1
Waupaca	38	−11	19.3	2.47	16.8
Wausau	37	−15	17.4	2.50	14.5
Wausaukee	42	−10	19.8	1.85	16.5
West Bend	50	− 2	23.0	......	......
Westfield	45	− 8	21.2	1.39	9.5
Whitehall	39	−20	19.4	1.65	......
Wyoming.					
Alcova	57	−17	25.7	......	......
Basin	50	−11	19.7	1.94	19.4
Big Piney	48	−12	20.9	1.05	10.5
Binford [f]	......	......	25.7	1.86	18.6
Bitter Creek	62	5	32.6	1.40	18.0
Burns	51	− 8	22.6	1.10	11.0
Carbon	50	− 5	21.0	1.20	......
Centennial	48	−23	22.8	6.00	60.0
Cody	62	− 6	25.2	0.31	3.1
Dome Lake	40	− 3	17.6	0.60	6.0
Embar	59	− 2	27.4	0.80	8.0
Evanston	53	1	25.4	5.12	29.0
Fort Laramie	67	−13	27.2	1.73	19.3
Fort Washakie	65	− 7	27.6	0.83	8.3
Fort Yellowstone	49	−10	23.0	3.00	25.0
Four Bear	54	−13	22.7	0.99	15.2
Hecla	57	−15	27.2	1.24	17.3
Laramie	52	−14	24.4	1.11	10.0
Lovell	55	− 8	19.3	0.45	4.0
Lusk	57	− 7	23.3	2.25	22.5
Rawlins	50	− 6	24.4	3.01	30.1
Rocksprings	60	− 2	32.6	1.67	16.7
Sheridan	54	−13	20.6	2.05	20.5
Sherman	......	......	......	3.70	37.0
Sundance	50	−12	19.6	2.20	22.0
Thayne	56	− 3	32.5	1.33	8.9
Wamsutter	......	......	......	1.10	11.0
Wheatland	60	− 9	27.8	2.30	23.0
Mexico.					
Ciudad P. Diaz	96	39	68.3	0.04	
Coatzacoalcos [2]	......	......	78.8	......	
Leon de Aldamas	86	34	63.2	0.00	
Puebla	84	31	59.5	0.00	
Tampico [2]	......	......	71.0	......	
Topolabampo	86	56	68.6	0.00	
Vera Cruz [2]	......	......	74.5	......	
New Brunswick.					
St. John	44	4	27.3	8.25	21.9
Porto Rico.					
Puerta de Tierra	86	66	75.0	2.76	

Late reports for February, 1899.

Stations.	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Alabama.					
Livingston	......	......	......	4.72	8.5
Alaska.					
Coal Harbor	45	0	32.0	3.77	1.5
Juneau	42	4	26.0	4.92	25.0
Kodiak	52	5	33.5	4.44	......
Killisnoo	42	3	26.5	4.80	24.5
Skaguay	44	− 9	19.7	0.88	4.5
California.					
Hill Ranch	93	21	55.4	0.03	
Georgia.					
Columbus	......	......	......	4.88	......
Indiana.					
Greensburg	......	......	......	3.06	18.6
Maryland.					
Charlotte Hall	75	−19	29.6	......	......
Massachusetts.					
Leicester Hill	50	−12	21.1	3.24	25.0
Michigan.					
North Manitou Island [10]	40	−23	12.8	......	......
New Mexico.					
Clayton	54	−18	24.0	......	......
Ohio.					
Demos	56	−26	21.2	1.53	......
Oregon.					
Tillamook Rock	......	......	......	6.95	......
Texas.					
Albany	......	......	......	0.20	2.0
Utah.					
Scipio	......	......	......	2.28	15.0
Washington.					
Snoqualmie	56	9	39.7	8.75	......
New Brunswick.					
St. John	42	− 6	19.0	3.14	10.6

TABLE III.—*Mean temperature for each hour of seventy-fifth meridian time, March, 1899.*

Stations.	1 a. m.	2 a. m.	3 a. m.	4 a. m.	5 a. m.	6 a. m.	7 a. m.	8 a. m.	9 a. m.	10 a. m.	11 a. m.	Noon.	1 p. m.	2 p. m.	3 p. m.	4 p. m.	5 p. m.	6 p. m.	7 p. m.	8 p. m.	9 p. m.	10 p. m.	11 p. m.	Midn't.	Mean.
Bismarck, N. Dak....	7.7	7.2	6.2	4.6	3.3	1.9	1.0	−0.2	0.3	2.9	6.7	10.6	14.3	17.0	18.5	19.5	20.0	20.1	18.8	16.7	14.4	11.8	10.4	9.2	7.8
Boston, Mass	32.1	31.6	31.0	30.8	30.6	30.8	30.8	31.6	32.8	33.9	34.8	36.1	36.9	37.8	37.9	37.5	37.1	36.3	35.5	34.8	34.4	33.9	33.2	32.6	34.0
Buffalo, N. Y.........	30.3	30.3	29.8	29.9	29.7	29.2	29.4	29.4	29.2	29.9	30.9	31.9	33.0	33.5	33.5	33.7	33.3	32.7	31.5	31.1	30.7	30.8	30.7	30.7	31.0
Chicago, Ill..........	28.1	27.8	27.5	27.2	26.6	26.1	26.1	26.4	26.3	27.0	27.8	29.0	29.6	30.5	31.4	31.5	31.5	31.2	30.8	30.7	30.1	29.7	29.4	28.8	28.8
Cincinnati, Ohio....	39.0	38.2	37.5	37.1	36.5	36.2	35.4	36.1	36.5	38.0	40.1	42.3	43.6	41.5	45.3	45.9	46.1	45.9	44.7	43.1	42.0	41.2	40.3	39.4	40.6
Cleveland, Ohio	31.3	31.3	31.1	31.1	31.1	30.7	30.8	30.9	31.1	31.9	32.8	33.8	34.5	34.7	34.7	35.0	34.8	34.5	33.9	33.6	33.0	32.2	32.0	31.8	32.6
Detroit, Mich........	28.2	27.6	27.4	27.2	27.0	27.0	26.6	27.0	27.4	28.2	29.0	30.0	30.5	31.1	31.6	31.7	31.7	31.2	30.4	30.1	29.3	28.9	28.5	28.5	29.0
Dodge, Kans..........	33.5	32.5	31.5	30.7	29.8	28.6	28.0	26.7	27.5	31.0	35.5	39.7	42.9	45.7	48.3	49.6	50.3	49.7	48.2	43.0	39.8	37.6	35.5	34.1	37.5
Eastport, Me..........	28.0	27.5	26.7	26.2	25.6	25.2	24.9	25.1	26.1	27.2	28.5	29.5	30.1	30.6	30.8	31.0	30.9	30.6	29.9	29.5	29.0	28.6	28.3	28.0	28.2
Galveston, Tex........	61.2	60.8	60.5	60.2	59.9	59.8	59.6	59.8	60.2	61.3	62.8	64.2	64.9	65.5	66.0	66.0	65.5	64.9	64.0	63.2	62.5	62.0	61.5	61.5	62.4
Havre, Mont..........	6.9	6.1	5.4	4.9	4.5	3.6	3.4	3.0	2.1	3.3	5.7	7.8	9.8	11.7	13.5	15.0	16.8	17.0	16.7	14.5	12.2	10.5	9.2	8.2	8.8
Independence, Cal..	48.7	48.3	47.2	46.4	44.9	44.4	43.8	43.2	42.1	42.9	46.4	49.0	52.2	54.9	57.2	58.7	60.0	59.9	59.3	58.4	55.2	52.7	51.5	50.0	50.7
Kansas City, Mo.....	32.4	31.9	30.6	29.9	29.7	29.4	29.0	28.7	29.0	30.6	32.3	34.2	35.9	37.4	38.4	39.8	40.5	40.7	39.7	38.5	37.2	35.8	34.2	33.1	34.1
Key West, Fla........	70.5	70.1	70.0	69.9	69.9	70.0	70.1	71.3	73.0	74.1	74.9	75.4	75.8	75.6	75.8	75.7	75.0	74.0	72.7	72.5	71.8	71.5	71.0	70.8	72.6
Marquette, Mich	14.2	13.6	13.2	12.7	12.3	11.9	11.7	12.7	14.1	15.7	17.5	18.5	19.4	20.1	20.3	20.2	20.0	19.6	18.6	18.0	16.6	15.9	15.3	15.0	16.1
Memphis, Tenn.......	49.3	48.4	47.5	46.9	46.4	45.7	45.3	45.2	46.2	47.9	50.0	51.6	53.0	54.1	55.4	56.2	56.5	55.9	54.6	53.8	52.3	51.5	50.8	49.9	50.6
Mt. Tamalpais, Cal..	43.5	43.3	42.7	42.4	42.3	42.4	42.2	42.2	42.0	42.0	42.5	43.6	44.3	45.5	46.6	47.3	47.6	46.7	46.4	46.2	44.7	44.2	44.0	43.7	44.1
New Orleans, La.....	60.9	60.6	60.3	59.7	59.4	59.0	58.9	59.3	60.2	62.7	65.5	67.5	69.3	70.7	71.6	71.7	71.0	69.6	67.8	65.9	64.0	62.9	62.4	61.5	64.3
New York, N. Y.....	35.3	35.1	34.7	34.6	34.9	34.8	35.2	36.4	36.9	38.0	38.9	39.7	40.5	41.1	42.1	42.4	42.2	40.9	38.9	38.4	37.8	37.5	36.9	36.4	38.0
Philadelphia, Pa.....	37.4	37.2	36.9	36.6	36.5	36.5	36.8	37.5	38.5	39.9	41.2	42.4	43.5	44.8	45.7	45.5	44.8	43.5	41.8	40.7	39.5	38.9	38.5	38.0	40.1
Pittsburg, Pa.........	38.6	37.8	37.1	36.6	36.2	36.1	35.8	35.8	35.9	36.8	38.1	39.8	41.5	43.2	44.6	44.6	45.2	44.4	43.0	42.2	41.4	40.5	39.7	38.9	39.7
Portland, Oreg.......	42.9	42.4	41.8	41.2	40.7	40.3	39.5	39.2	38.0	37.7	38.6	40.1	42.7	44.6	45.9	47.0	47.5	48.9	49.1	48.7	47.8	46.0	45.0	44.0	43.3
St. Louis, Mo.........	37.5	36.8	36.3	36.7	35.3	34.6	34.5	34.4	34.9	36.4	37.8	39.4	40.9	42.6	43.7	44.5	44.3	43.5	42.7	41.4	40.4	39.4	38.6	37.8	38.9
St. Paul, Minn.......	16.2	15.6	14.6	14.1	13.6	13.2	12.7	11.7	12.0	13.6	15.7	17.6	19.4	20.7	22.0	22.9	23.6	23.8	23.4	22.0	21.0	20.0	18.8	17.9	17.8
Salt Lake City, Utah.	38.8	38.4	37.6	37.0	36.6	35.9	35.4	36.1	35.0	35.4	36.9	39.5	41.1	42.5	43.6	44.9	45.6	46.3	45.5	44.4	43.5	41.7	40.6	39.5	40.0
San Diego, Cal.......	54.8	54.2	53.5	53.2	52.9	52.5	51.8	51.3	51.4	51.6	53.8	56.5	58.6	60.0	60.8	61.1	61.2	60.9	60.2	59.9	58.6	57.5	56.4	55.8	56.2
San Francisco, Cal...	51.4	50.9	50.1	49.6	49.2	48.7	48.5	49.1	48.2	48.0	48.6	50.2	51.4	52.8	54.1	55.0	55.4	55.5	55.4	54.6	54.0	53.2	52.3	51.6	51.6
Santa Fe, N. Mex ...	37.1	36.4	35.6	34.9	33.5	32.5	31.5	30.9	31.1	35.3	38.2	40.8	43.2	44.9	46.8	47.9	48.9	49.3	48.2	46.5	42.5	40.6	39.1	37.8	39.7
Savannah, Ga........	56.0	55.7	55.3	55.0	54.8	54.5	54.3	55.4	59.0	62.3	65.2	67.7	68.9	69.2	69.1	68.3	66.5	64.3	61.8	60.0	59.0	58.3	57.7	56.9	60.6
Washington, D. C....	39.9	39.4	38.8	38.0	37.5	37.0	36.8	37.9	38.9	40.4	42.4	44.5	46.2	46.8	47.5	47.4	46.7	45.8	44.5	43.5	42.7	42.1	41.2	40.8	41.9
West Indies.																									
Basseterre, St. Kitts.	73.0	72.8	72.5	72.5	72.4	72.8	77.5	76.0	77.0	78.1	78.5	79.1	79.2	78.8	78.0	76.9	75.9	74.6	74.4	74.0	73.8	73.5	73.4	73.2	75.2
Bridgetown, Bar.....	72.7	72.7	72.5	72.5	72.3	73.1	76.3	77.7	78.9	80.3	81.2	81.5	80.9	80.3	79.5	77.9	76.1	74.8	74.4	74.0	73.7	73.8	73.5	73.1	76.0
Colon, U. S. C........	77.7	77.5	77.4	77.1	76.7	76.5	77.3	78.7	81.2	82.4	83.2	83.5	83.2	82.6	82.4	81.8	80.6	79.5	78.7	78.5	78.3	78.3	78.0	78.0	79.5
Havana, Cuba.......	69.6	68.9	68.0	67.5	67.1	67.0	66.9	68.8	72.5	76.0	78.1	79.3	79.4	79.5	79.4	78.7	77.8	76.8	75.3	74.0	73.1	72.4	71.6	70.6	73.3
Kingston, Jamaica ..	69.1	68.8	68.5	68.3	68.0	68.1	68.0	74.4	78.4	80.2	81.4	82.2	81.8	81.6	80.1	79.5	79.1	77.7	75.6	73.9	72.4	71.0	70.1	69.6	74.5
Port of Spain, Trin..	71.8	71.3	70.9	70.9	71.1	72.3	75.5	78.9	80.8	82.8	83.9	83.2	83.3	82.4	82.1	80.6	78.7	76.9	75.8	75.5	74.5	73.8	73.3	72.6	76.8
Rosseau, Dominica..	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
San Juan, P. R.......	70.9	70.8	70.4	70.0	69.7	70.0	72.5	75.3	77.3	78.3	79.0	79.3	79.5	79.5	78.9	77.9	76.9	76.0	74.9	74.3	73.7	72.9	72.5	72.0	74.7
Santiago de Cuba...	70.7	70.1	69.6	69.2	68.8	68.7	70.1	74.3	78.0	80.6	82.7	83.5	83.3	83.0	82.2	81.2	80.1	78.0	76.5	75.5	74.2	73.4	72.6	71.6	75.8
Santo Domingo, S. D.	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Willemstad, Curaçao	74.8	74.5	74.0	73.9	73.9	74.3	76.2	77.4	78.8	79.5	80.1	80.6	80.8	80.8	80.4	79.3	77.5	76.6	76.0	76.0	75.8	75.7	75.4	75.0	77.0

TABLE IV.—*Mean pressure for each hour of seventy-fifth meridian time, March, 1899.*

Stations.	1 a. m.	2 a. m.	3 a. m.	4 a. m.	5 a. m.	6 a. m.	7 a. m.	8 a. m.	9 a. m.	10 a. m.	11 a. m.	Noon.	1 p. m.	2 p. m.	3 p. m.	4 p. m.	5 p. m.	6 p. m.	7 p. m.	8 p. m.	9 p. m.	10 p. m.	11 p. m.	Midn't.	Mean.
Bismarck, N. Dak....	28.262	.263	.262	.261	.259	.259	.264	.268	.268	.265	.263	.263	.257	.252	.242	.235	.232	.232	.237	.245	.256	.264	.271	.275	.257
Boston, Mass.........	29.799	.791	.788	.792	.797	.807	.816	.822	.822	.823	.820	.812	.798	.795	.788	.787	.789	.789	.788	.791	.792	.794	.795	.791	.799
Buffalo, N. Y.........	29.051	.049	.047	.051	.056	.066	.076	.078	.085	.078	.075	.066	.053	.042	.041	.042	.045	.050	.057	.059	.063	.061	.057	.052	.057
Chicago, Ill..........	29.062	.057	.052	.045	.045	.049	.055	.064	.062	.064	.065	.065	.062	.051	.041	.041	.042	.050	.054	.062	.066	.068	.069	.071	.057
Cincinnati, Ohio	29.269	.271	.265	.257	.262	.274	.289	.296	.299	.302	.296	.289	.277	.267	.256	.254	.247	.250	.254	.263	.265	.274	.278	.278	.272
Cleveland, Ohio	29.082	.085	.078	.079	.085	.091	.096	.098	.103	.101	.097	.090	.079	.070	.066	.071	.068	.074	.080	.087	.091	.092	.088	.081	.085
Detroit, Mich.........	29.142	.144	.138	.132	.135	.142	.147	.149	.153	.154	.152	.148	.141	.131	.119	.118	.118	.119	.127	.134	.138	.141	.140	.143	.138
Dodge, Kans	27.304	.306	.303	.301	.297	.297	.303	.309	.319	.325	.323	.313	.300	.285	.268	.249	.245	.243	.251	.274	.281	.295	.309	.316	.292
Eastport, Me	29.841	.836	.829	.827	.827	.831	.840	.850	.857	.859	.855	.850	.838	.833	.827	.826	.833	.839	.846	.855	.854	.850	.850	.841	.841
Galveston, Tex.......	29.901	.900	.893	.886	.885	.893	.903	.913	.926	.938	.942	.941	.928	.913	.889	.874	.863	.861	.862	.869	.880	.894	.902	.905	.898
Havre, Mont..........	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Independence, Cal..	25.898	.899	.903	.906	.906	.905	.905	.913	.912	.928	.936	.944	.942	.932	.913	.892	.874	.865	.857	.855	.858	.866	.880	.890	.900
Kansas City, Mo.....	28.945	.944	.943	.947	.940	.941	.947	.949	.954	.957	.957	.957	.950	.937	.923	.908	.905	.904	.909	.919	.930	.943	.952	.958	.938
Key West, Fla........	30.032	.045	.037	.029	.027	.034	.049	.062	.074	.080	.081	.072	.055	.039	.023	.011	.006	.009	.017	.029	.041	.050	.055	.053	.043
Marquette, Mich ...	29.172	.173	.165	.157	.156	.158	.164	.165	.165	.165	.165	.166	.165	.157	.153	.157	.159	.168	.174	.176	.179	.183	.181	.180	.167
Memphis, Tenn.......	29.548	.550	.550	.548	.553	.561	.571	.583	.599	.604	.600	.594	.577	.557	.534	.525	.515	.520	.521	.525	.531	.542	.549	.555	.555
Mt. Tamalpais, Cal .	27.544	.545	.548	.548	.546	.537	.530	.532	.539	.544	.557	.561	.569	.570	.565	.554	.543	.535	.528	.522	.522	.527	.532	.539	.541
New Orleans, La.....	29.955	.954	.953	.947	.945	.957	.969	.984	.998	.005	.005	.999	.984	.965	.942	.929	.920	.919	.925	.933	.945	.953	.961	.963	.959
New York, N. Y.....	29.617	.610	.603	.602	.607	.615	.622	.625	.623	.622	.615	.606	.592	.577	.564	.562	.571	.581	.596	.606	.618	.622	.621	.615	.604
Philadelphia, Pa.....	29.840	.834	.825	.827	.833	.843	.848	.855	.859	.861	.855	.841	.825	.806	.796	.799	.805	.813	.825	.836	.843	.847	.844	.840	.833
Pittsburg, Pa.........	29.008	.010	.007	.004	.009	.013	.024	.028	.034	.036	.043	.021	.006	.988	.985	.985	.990	.997	.012	.016	.021	.020	.021	.018	.012
Portland, Oreg......	29.839	.845	.846	.850	.855	.853	.849	.847	.849	.851	.860	.866	.869	.867	.863	.852	.839	.833	.831	.828	.825	.835	.842	.846	.848
St. Louis, Mo.........	29.344	.346	.343	.336	.339	.346	.352	.362	.373	.378	.374	.368	.358	.344	.322	.319	.315	.313	.318	.327	.342	.349	.357	.354	.345
St. Paul, Minn.......	29.084	.084	.087	.086	.082	.088	.092	.098	.107	.112	.118	.117	.113	.107	.091	.083	.077	.074	.077	.083	.085	.086	.090	.091	.092
Salt Lake City, Utah.	25.517	.516	.516	.519	.512	.507	.511	.516	.524	.537	.545	.550	.554	.551	.541	.528	.520	.515	.514	.512	.514	.515	.517	.522	.524
San Diego, Cal.......	29.947	.947	.944	.942	.934	.924	.921	.923	.932	.945	.958	.968	.968	.963	.947	.929	.919	.913	.910	.911	.915	.922	.933	.942	.936
San Francisco, Cal...	29.909	.912	.912	.916	.909	.899	.898	.902	.907	.914	.925	.927	.930	.929	.923	.909	.896	.892	.886	.881	.885	.888	.895	.902	.906
Santa Fe, N. Mex ...	23.121	.121	.121	.122	.119	.117	.120	.125	.133	.144	.147	.148	.141	.128	.112	.096	.087	.084	.084	.091	.100	.112	.120	.128	.118
Savannah, Ga........	29.963	.959	.952	.948	.954	.960	.977	.985	.996	.998	.996	.983	.964	.943	.928	.921	.920	.928	.939	.945	.954	.959	.960	.959	.958
Washington, D. C....	29.841	.840	.832	.839	.845	.848	.866	.880	.881	.879	.865	.852	.837	.825	.821	.817	.824	.832	.844	.851	.856	.854	.848	.844	.847
West Indies.																									
Basseterre, St. Kitts.	29.984	.968	.962	.958	.969	.992	.008	.021	.035	.037	.028	.007	.986	.967	.958	.955	.962	.971	.984	.000	.010	.012	.009	.995	.991
Bridgetown, Bar....	29.924	.918	.919	.925	.937	.953	.965	.978	.980	.977	.958	.939	.924	.910	.906	.911	.920	.930	.941	.951	.957	.957	.952	.941	.941
Colon, U. S. C........	29.850	.845	.831	.829	.842	.842	.865	.878	.895	.900	.893	.876	.853	.833	.807	.796	.797	.805	.819	.840	.854	.865	.868	.867	.848
Havana, Cuba.......	29.984	.971	.957	.952	.956	.968	.982	.995	.007	.016	.014	.001	.981	.962	.946	.937	.939	.946	.959	.971	.985	.994	.995	.990	.975
Kingston, Jamaica..	29.694	.680	.663	.660	.662	.676	.694	.708	.717	.720	.712	.691	.666	.649	.635	.629	.633	.643	.660	.680	.696	.710	.707	.701	.678
Port of Spain, Trin..	29.874	.865	.862	.865	.878	.900	.917	.927	.932	.920	.896	.874	.851	.835	.831	.834	.844	.856	.873	.887	.898	.904	.901	.887	.880
Roseau, Dominica ..	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
San Juan, P. R......	29.930	.921	.920	.932	.937	.952	.969	.983	.986	.985	.972	.953	.935	.920	.907	.907	.917	.924	.939	.954	.963	.963	.956	.946	.944
Santiago de Cuba...	29.902	.885	.874	.873	.884	.897	.913	.928	.934	.934	.923	.839	.874	.860	.848	.842	.850	.862	.877	.899	.913	.921	.920	.914	.893
Santo Domingo, S. D.	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Willemstad, Curaçao	29.848	.837	.832	.832	.843	.859	.878	.891	.904	.901	.885	.865	.840	.818	.801	.798	.803	.813	.830	.845	.864	.873	.872	.861	.850

TABLE V.—*Average wind movement for each hour of seventy-fifth meridian time, March, 1899.*

Stations.	1 a. m.	2 a. m.	3 a. m.	4 a. m.	5 a. m.	6 a. m.	7 a. m.	8 a. m.	9 a. m.	10 a. m.	11 a. m.	Noon.	1 p. m.	2 p. m.	3 p. m.	4 p. m.	5 p. m.	6 p. m.	7 p. m.	8 p. m.	9 p. m.	10 p. m.	11 p. m.	Midnight.	Mean.
Abilene, Tex	11.7	12.3	12.3	12.0	13.4	12.2	11.7	11.1	12.4	15.4	17.1	17.9	18.1	18.0	17.3	15.7	14.9	14.5	13.9	11.8	9.9	10.1	10.8	11.0	13.6
Albany, N. Y	7.2	7.3	7.7	7.9	7.3	8.3	8.4	9.5	10.1	11.1	11.2	11.0	11.2	10.9	11.7	11.6	10.9	10.1	8.8	9.0	8.3	8.2	7.2	6.5	9.2
Alpena, Mich	9.7	9.9	9.7	10.4	9.9	9.4	8.8	9.6	10.9	11.3	11.2	11.9	11.9	11.9	13.2	14.2	14.2	13.7	12.5	11.5	11.2	10.8	11.1	10.4	11.2
Amarillo, Tex	18.8	18.8	19.5	20.1	19.5	18.3	18.3	19.3	17.6	17.0	18.8	19.3	20.4	19.4	19.2	19.3	19.8	20.0	19.9	18.0	15.6	16.0	18.1	17.3	18.7
Atlanta, Ga	11.1	11.0	10.4	10.9	11.4	10.9	9.9	10.5	11.1	11.0	12.0	12.2	12.1	12.4	12.6	12.3	12.8	12.0	10.4	10.5	10.8	11.0	11.2	11.3	11.3
Atlantic City, N. J	12.3	12.8	12.9	12.9	13.0	12.7	13.7	13.5	14.5	15.0	15.6	15.5	15.7	16.3	15.8	15.1	14.4	13.7	13.8	12.4	12.2	12.8	12.1	11.7	13.7
Augusta, Ga	7.0	6.9	6.3	5.7	5.5	5.4	5.0	5.9	7.1	8.6	10.4	11.5	12.7	13.0	12.9	12.9	11.9	10.5	8.1	7.5	7.7	7.7	7.8	7.4	8.6
Baker City, Oreg	4.4	5.9	5.8	6.2	5.4	5.1	4.8	4.6	4.5	5.1	5.5	5.5	5.3	6.5	7.6	8.2	7.3	7.6	6.8	5.8	4.7	4.3	4.0	4.4	5.6
Baltimore, Md	5.8	5.7	5.2	5.7	5.5	5.7	5.3	6.7	6.8	6.7	7.3	7.8	8.0	8.4	8.5	8.3	8.7	7.9	6.9	6.5	6.3	6.3	6.6	5.9	6.8
Bismarck, N. Dak	9.1	9.4	9.1	8.5	8.6	8.4	8.5	8.1	8.0	9.0	10.4	11.3	12.6	13.1	13.6	14.4	14.7	14.5	12.7	10.5	9.5	9.9	9.5	9.5	10.5
Block Island, R. I	17.4	16.9	17.5	18.5	19.0	19.0	19.5	19.6	20.3	19.7	19.5	19.5	20.3	19.9	19.9	19.9	19.4	18.5	17.9	17.6	17.0	17.3	17.3	17.5	18.7
Boise, Idaho	4.9	5.0	4.7	4.7	4.6	4.4	4.2	4.0	4.5	4.7	5.0	5.8	7.6	7.9	7.7	8.8	8.8	9.4	9.4	8.1	6.7	5.4	5.3	5.5	6.1
Boston, Mass	12.9	12.5	12.5	12.8	13.0	13.1	14.0	14.1	15.0	15.2	16.0	15.7	15.1	15.5	15.5	15.2	15.1	14.5	13.8	13.2	12.4	12.5	12.4	12.3	13.9
Buffalo, N. Y	15.6	15.4	16.0	15.7	15.0	14.1	14.0	15.0	16.1	16.2	16.9	17.6	18.8	18.8	19.0	18.3	18.8	18.6	18.6	18.7	17.9	16.9	16.8	16.5	16.9
Cairo, Ill	12.4	12.8	13.5	13.2	12.8	12.8	11.4	12.0	12.3	12.3	12.1	12.1	11.7	12.1	12.3	12.1	11.5	12.4	12.1	11.0	11.0	11.8	12.5	12.0	12.2
Cape Henry, Va	14.8	15.0	14.5	14.1	14.5	14.8	14.5	13.2	13.6	14.2	14.6	15.7	15.6	15.5	16.8	16.0	14.9	13.5	13.3	13.7	13.6	14.4	15.1	14.8	14.6
Carson City, Nev	9.8	10.8	11.0	10.4	9.7	9.5	8.8	9.6	9.2	9.7	9.1	9.4	11.0	11.6	12.3	13.4	14.9	14.7	15.9	16.4	14.7	12.5	10.7	10.6	11.5
Charleston, S. C	10.9	10.6	10.0	9.8	10.1	9.3	9.3	9.5	9.9	11.1	12.7	13.6	15.1	15.8	16.5	16.5	15.0	13.8	12.4	11.8	11.8	11.3	11.2	11.5	12.1
Charlotte, N. C	9.6	9.4	8.9	8.9	8.3	7.7	7.6	8.1	9.4	10.5	11.0	10.5	10.6	10.7	11.3	12.3	11.5	9.9	8.8	8.7	8.5	9.2	9.4	9.6	9.6
Chattanooga, Tenn	7.9	7.6	7.7	7.4	7.3	7.5	7.5	7.4	8.0	8.6	9.9	10.9	11.8	12.3	12.9	12.8	12.3	11.0	9.6	8.7	7.8	7.6	7.8	7.7	9.2
Cheyenne, Wyo	10.4	10.3	10.1	11.1	10.0	11.3	10.6	11.0	12.2	11.2	13.5	15.4	18.0	19.1	18.7	17.6	17.4	16.9	15.2	12.5	10.4	9.6	9.6	10.0	13.0
Chicago, Ill	17.4	17.6	17.2	17.7	18.2	17.7	17.7	17.7	17.7	18.4	18.6	18.0	17.7	18.4	19.0	19.7	20.2	20.2	19.6	19.1	18.4	18.8	18.5	18.2	18.4
Cincinnati, Ohio	9.3	9.6	8.6	9.2	9.2	9.1	8.8	9.5	10.8	11.3	11.5	11.6	13.0	12.8	12.7	12.5	12.3	11.3	10.6	10.8	10.5	10.0	9.9	10.2	10.6
Cleveland, Ohio	17.9	17.8	18.0	17.9	17.2	17.1	17.4	18.5	18.0	17.8	18.0	18.5	17.4	18.2	17.9	19.1	17.8	16.9	16.3	17.0	17.4	17.7	17.9	17.8	17.7
Columbia, Mo	10.9	11.0	10.8	10.2	10.2	10.2	9.8	9.8	10.9	11.5	12.0	12.1	13.1	13.5	13.8	13.2	14.1	13.6	13.4	12.3	11.7	11.4	11.5	10.8	11.8
Columbus, Ohio	9.5	9.2	9.0	9.7	9.3	9.3	9.7	9.9	10.6	11.3	11.6	11.9	12.0	12.2	12.5	12.4	11.8	10.5	10.1	9.9	9.9	10.0	9.2	9.8	10.5
Concordia, Kans	7.6	8.0	7.8	8.5	9.4	9.0	8.7	8.8	8.6	9.5	10.2	10.7	10.3	10.7	10.2	9.9	9.7	9.5	8.7	7.6	7.7	7.8	7.9	7.4	8.9
Corpus Christi, Tex	16.3	15.5	14.5	13.9	13.1	12.2	12.5	12.1	11.8	12.5	13.5	14.8	16.2	17.2	18.1	18.1	18.6	17.9	17.8	16.8	15.9	15.7	15.9	15.8	15.3
Davenport, Iowa	9.4	9.1	8.5	8.5	8.5	8.5	8.7	8.7	9.5	10.4	10.8	11.0	11.9	12.5	12.2	13.1	12.4	11.9	10.3	9.9	9.8	9.7	9.1	9.3	10.2
Denver, Colo	7.0	7.2	6.9	7.3	7.4	6.5	7.5	7.7	7.5	8.5	9.1	9.6	11.4	11.5	11.9	11.6	12.4	12.7	11.7	10.8	9.1	7.5	6.7	6.5	9.0
Des Moines, Iowa	8.1	8.1	8.4	7.8	8.4	8.1	7.9	8.7	9.4	10.5	10.9	11.5	12.2	12.0	12.0	12.5	12.5	11.9	10.4	9.1	8.7	8.7	8.5	8.5	9.8
Detroit, Mich	11.0	11.0	11.3	11.7	10.8	10.3	10.9	10.9	11.3	11.6	11.4	12.0	11.6	11.8	12.1	12.8	11.9	11.8	11.7	12.0	11.8	11.9	11.4	10.9	11.5
Dodge, Kans	11.9	11.5	11.7	12.2	12.0	12.0	11.7	11.5	12.1	13.8	15.0	15.5	15.1	14.1	14.1	13.8	13.8	13.5	13.3	11.7	11.2	10.9	11.7	12.0	12.7
Dubuque, Iowa	8.6	8.5	8.0	8.2	7.7	7.2	7.3	7.5	9.1	10.9	11.2	11.6	12.0	12.4	12.7	12.9	13.2	12.2	11.4	10.2	9.9	9.5	9.2	8.7	10.0
Duluth, Minn	13.4	14.3	13.3	11.9	10.8	10.4	10.2	11.2	10.6	10.8	10.9	11.2	11.1	11.9	12.2	12.1	12.0	11.4	10.8	10.2	10.1	10.7	12.2	12.9	11.5
Eastport, Me	14.5	14.9	15.3	15.1	15.5	15.4	15.9	15.9	15.7	15.9	16.8	16.0	15.2	14.9	14.8	14.8	13.8	13.0	12.0	11.7	12.1	13.4	14.1	14.0	14.6
Elkins, W. Va	7.6	7.7	7.0	7.3	6.8	6.2	6.4	6.5	7.4	7.7	9.5	10.0	10.2	10.3	10.8	10.6	10.2	8.9	8.5	8.0	7.6	8.0	8.0	7.3	8.3
El Paso, Tex	13.8	12.5	12.4	12.3	11.3	10.7	11.0	11.5	10.0	10.0	12.8	16.7	19.7	20.7	21.0	21.9	23.4	24.1	23.5	20.7	17.4	14.6	13.5	12.7	15.8
Erie, Pa	13.3	14.6	14.6	14.6	14.1	13.5	13.7	13.8	14.5	14.8	15.1	14.2	14.5	14.4	14.6	13.7	14.2	13.7	12.6	13.1	13.8	13.4	13.3	13.4	14.0
Escanaba, Mich	7.5	7.6	7.5	8.0	7.6	7.8	7.6	7.5	7.9	8.7	9.2	9.4	9.7	10.5	11.2	12.1	12.2	11.9	11.1	10.1	9.3	8.6	8.2	7.6	9.1
Eureka, Cal	5.0	4.7	4.0	4.6	4.2	4.4	4.4	5.1	4.7	4.4	4.7	4.4	4.7	6.3	8.4	9.8	11.0	12.3	12.2	11.0	9.9	8.6	7.4	6.0	6.8
Evansville, Ind	9.2	8.8	9.6	9.9	9.6	8.3	8.2	9.2	10.2	10.5	10.7	11.2	10.6	10.1	10.4	10.4	10.5	10.9	10.1	8.7	8.9	8.9	8.8	9.3	9.7
Fort Canby, Wash	10.5	11.4	11.8	10.7	10.5	10.2	9.6	10.6	11.6	12.4	10.9	11.2	11.8	11.8	12.1	12.5	13.2	12.9	13.2	11.6	11.6	10.0	9.4	9.5	11.3
Fort Smith, Ark	8.0	7.9	8.3	8.2	8.5	7.9	8.0	8.1	9.1	10.3	11.6	11.5	12.0	13.1	13.6	13.9	13.1	12.4	11.1	9.7	9.1	8.8	8.6	8.8	10.1
Fresno, Cal	6.5	6.6	6.4	6.2	5.3	5.2	5.0	5.2	4.7	4.5	4.9	5.9	6.8	7.0	7.5	7.1	7.6	7.5	8.1	8.2	6.4	5.6	6.1	6.6	6.3
Galveston, Tex	11.4	11.4	11.4	11.2	10.9	9.8	9.1	9.5	10.1	10.4	11.3	11.9	12.0	11.4	11.0	11.2	11.1	10.7	10.7	11.1	11.0	11.8	12.3	11.8	11.0
Grand Haven, Mich	11.1	11.0	11.1	11.2	10.9	10.5	10.2	10.1	10.8	11.8	11.9	11.6	12.5	12.0	11.7	11.9	12.1	11.1	10.7	11.2	11.1	10.8	11.2	11.1	11.2
Grand Junction, Colo	5.2	4.6	4.2	4.7	5.3	5.4	5.6	6.1	6.2	6.5	6.7	7.7	8.8	9.7	10.4	10.5	10.2	10.3	9.7	8.1	5.8	5.1	5.2	5.3	7.0
Green Bay, Wis	7.6	7.4	7.3	7.1	7.0	7.3	7.4	7.5	8.1	8.7	8.7	9.3	9.7	10.5	10.8	10.7	10.7	10.2	9.9	9.6	8.9	8.2	8.0	8.4	8.7
Hannibal, Mo	11.4	11.3	11.4	11.4	11.0	10.3	10.3	9.9	11.0	11.0	11.5	13.0	14.2	14.2	14.1	14.8	13.8	13.0	12.6	12.1	12.1	11.9	11.4	11.0	12.0
Harrisburg, Pa	9.4	9.3	9.0	8.9	8.5	8.7	9.0	8.7	8.9	10.0	10.1	10.5	11.7	11.8	11.9	12.6	12.0	11.3	9.8	9.6	9.9	10.2	9.9	9.8	10.1
Hatteras, N. C	14.2	14.4	15.2	14.9	14.8	14.9	14.3	14.7	14.6	14.8	14.9	15.6	15.7	16.3	16.5	17.0	16.7	16.3	15.5	15.5	15.9	16.2	15.7	15.3	15.4
Havre, Mont	7.3	8.0	7.5	8.5	8.6	8.5	8.4	8.5	8.6	9.0	9.6	10.1	11.0	11.9	11.7	11.4	11.1	10.9	10.9	11.0	10.7	9.9	8.7	8.1	9.6
Helena, Mont	6.5	6.3	6.2	5.7	5.4	5.2	5.4	6.1	6.2	6.2	6.5	6.5	7.0	7.8	8.1	7.6	7.3	7.3	6.7	6.7	6.5	6.7	6.4	6.8	6.5
Huron, S. Dak	11.6	12.5	12.7	12.7	12.8	13.0	12.0	12.7	11.8	13.8	14.4	14.6	14.4	15.1	15.2	14.8	14.3	13.7	13.2	12.3	11.5	12.1	12.2	12.3	13.2
Idaho Falls, Idaho	11.7	12.6	12.5	12.1	12.3	12.3	12.2	12.1	11.5	12.3	14.0	15.0	14.8	16.4	17.9	18.7	19.4	19.0	18.5	17.0	14.5	14.0	12.8	11.7	14.4
Independence, Cal	9.9	9.6	10.1	10.2	9.9	8.8	9.3	10.1	9.6	8.7	9.7	11.6	13.1	12.9	13.4	14.1	13.7	14.8	16.8	16.8	15.1	13.4	12.1	10.5	11.8
Indianapolis, Ind	11.6	11.8	11.9	11.1	11.6	11.8	11.8	12.2	12.8	13.2	13.9	13.6	14.5	14.9	14.8	15.0	15.1	14.8	13.9	12.8	13.3	12.9	12.9	12.7	13.1
Jacksonville, Fla	6.5	6.8	6.5	6.7	6.3	6.2	5.9	6.3	7.4	8.6	9.3	10.4	10.8	11.2	11.5	11.3	11.9	11.1	9.4	8.0	7.4	6.9	6.6	6.4	8.3
Jupiter, Fla	8.1	8.1	7.8	7.1	7.2	7.0	6.5	6.9	9.4	11.5	12.9	14.1	14.4	14.8	15.1	14.8	14.2	12.8	10.7	9.3	8.8	8.1	8.1	8.4	10.3
Kansas City, Mo	9.2	9.5	9.3	9.0	9.1	8.7	8.5	9.0	10.1	11.4	12.0	12.4	13.5	13.1	13.1	12.4	12.6	12.3	11.4	9.9	8.9	8.9	9.1	9.4	10.5
Keokuk, Iowa	9.5	9.5	9.5	9.1	9.2	9.2	8.6	8.6	9.3	10.1	10.1	11.3	11.6	12.4	12.4	12.9	12.4	11.1	10.7	9.9	9.2	9.5	9.6	9.6	10.2
Key West, Fla	8.7	8.4	8.2	8.0	8.4	8.3	8.4	8.3	9.5	10.2	10.8	11.0	11.5	11.5	11.0	10.7	10.5	10.1	10.0	9.7	9.7	9.7	9.3	8.5	9.6
Kittyhawk, N. C	15.3	15.1	14.4	14.6	14.5	14.0	13.5	14.3	14.9	15.7	16.7	17.8	18.5	19.0	18.1	17.0	16.6	15.8	14.6	16.9	17.2	16.2	15.5	15.7	15.9
Knoxville, Tenn	8.5	8.0	7.8	8.6	9.5	10.0	9.2	9.2	10.0	10.1	11.1	10.7	11.9	12.2	13.4	13.3	13.4	12.6	11.7	10.0	9.7	9.4	9.2	8.8	10.3
La Crosse, Wis	4.8	4.6	5.0	5.5	6.5	6.8	6.1	6.1	6.0	6.3	6.9	8.1	8.7	9.1	9.5	10.4	10.6	9.7	9.7	8.3	6.8	6.5	5.6	5.6	7.2
Lander, Wyo	4.8	4.5	4.7	4.1	4.2	3.8	4.1	3.8	3.8	3.7	4.1	4.6	5.2	5.4	6.1	6.5	6.5	6.5	6.2	5.9	4.9	5.1	5.5	4.4	4.9
Lexington, Ky	13.3	12.6	13.0	14.0	14.0	14.0	14.4	14.5	14.4	14.9	15.2	16.0	17.0	17.3	16.3	16.2	15.4	14.2	13.1	12.8	13.6	14.3	14.5	13.5	14.5
Little Rock, Ark	9.0	9.4	9.5	8.7	9.3	8.9	8.9	8.6	9.5	10.5	11.4	12.3	12.1	12.3	12.8	13.2	13.2	12.7	11.6	10.0	9.2	9.2	9.4	9.5	10.5
Los Angeles, Cal	3.3	3.4	3.2	3.3	3.8	3.5	3.5	3.5	3.4	3.8	4.0	4.4	5.0	5.3	6.6	7.7	8.6	9.1	8.9	8.2	6.9	4.8	3.7	3.4	5.1
Louisville, Ky	9.6	10.5	10.1	10.2	10.3	10.7	10.5	10.5	11.8	12.0	12.6	13.8	13.6	13.7	13.5	13.0	12.7	12.2	11.9	11.5	11.5	10.1	9.5	9.5	11.5
Lynchburg, Va	4.6	4.5	4.5	4.5	4.6	4.2	4.8	5.6	6.1	6.6	7.1	7.9	7.8	7.9	7.6	8.1	8.0	7.4	5.8	5.2	4.2	4.8	4.3	5.2	5.9
Marquette, Mich	8.3	8.9	8.5	8.7	8.3	7.3	6.9	7.6	7.9	8.9	9.9	10.0	10.6	11.4	11.7	11.7	11.3	10.5	9.2	7.8	7.5	7.4	7.8	8.1	9.0
Memphis, Tenn	13.1	14.2	13.8	13.9	13.1	12.8	12.1	12.1	12.6	12.8	13.7	14.3	13.6	13.7	14.7	14.3	13.7	13.1	12.7	12.4	12.4	13.3	13.3	12.8	13.3
Milwaukee, Wis	11.2	11.1	11.4	11.0	11.0	10.2	9.9	10.2	11.1	11.6	11.8	11.5	12.1	12.3	12.7	12.5	12.8	12.5	11.9	11.3	11.2	11.4	11.5	11.1	11.5
Minneapolis, Minn	12.0	11.8	11.0	11.3	11.6	12.1	12.3	12.0	12.0	12.8	13.2	13.9	14.2	14.4	14.7	14.8	14.4	13.8	13.2	11.4	12.0	12.0	12.9	12.4	12.8
Mobile, Ala	9.6	8.5	8.3	8.3	7.8	6.7	7.4	7.1	8.1	10.3	11.4	11.9	12.8	13.6	14.2	14.2	13.8	12.9	11.8	10.4	10.4	9.8	9.6	9.7	10.4
Montgomery, Ala	8.2	7.6	7.8	7.5	7.6	7.7	7.0	7.7	9.0	9.6	10.6	11.5	11.1	11.4	11.9	12.1	11.9	11.9	10.3	8.8	9.4	9.6	9.2	8.5	9.5
Moorhead, Minn	10.9	11.2	10.7	10.4	10.5	10.1	9.9	10.0	10.5	11.4	12.1	12.2	12.7	13.4	13.1	13.2	13.1	12.0	11.8	10.9	11.6	11.8	11.7	10.9	11.5
Mount Tamalpais, Cal	25.4	25.6	25.1	25.4	26.1	26.1	27.4	26.1	24.3	23.5	20.4	19.6	19.0	18.0	18.2	17.9	19.3	21.3	22.3	21.8	22.8	23.6	23.7	24.9	22.8
Nantucket, Mass	14.1	13.5	13.7	13.9	14.4	14.7	15.3	16.2	16.9	17.8	16.7	17.5	17.5	16.9	16.2	16.3	16.3	16.3	15.3	14.5	14.6	14.1	13.8	13.6	15.4
Nashville, Tenn	7.4	8.2	8.5	8.6	8.5	8.8	9.4	9.9	9.5	10.1	9.8	11.0	10.9	12.0	11.9	11.6	10.9	10.5	9.1	9.3	8.5	8.9	8.5	8.5	9.6
Neah, Wash	6.3	6.4	6.5	5.8	6.0	5.9	6.7	6.4	5.8	5.8	5.9	6.8	7.7	9.3	9.6	10.4	10.7	10.7	10.3	10.8	8.8	7.5	6.6	6.0	7.6
New Haven, Conn	9.7	9.6	8.8	9.9	9.5	9.6	9.8	11.6	13.2	14.2	13.9	13.6	13.6	13.4	12.4	12.3	12.1	11.0	9.9	10.5	10.2	10.3	10.2	10.0	11.2
New Orleans, La	10.0	9.7	9.7	9.4	9.5	9.2	8.9	9.3	10.7	12.0	13.6	14.5	15.5	15.4	15.8	15.1	14.7	14.0	12.3	11.0	10.1	10.5	11.1	10.5	11.7

TABLE V.—*Average wind movement, etc.*—Continued.

Stations.	1 a. m.	2 a. m.	3 a. m.	4 a. m.	5 a. m.	6 a. m.	7 a. m.	8 a. m.	9 a. m.	10 a. m.	11 a. m.	Noon.	1 p. m.	2 p. m.	3 p. m.	4 p. m.	5 p. m.	6 p. m.	7 p. m.	8 p. m.	9 p. m.	10 p. m.	11 p. m.	Midnight.	Mean.
New York, N. Y	19.1	17.5	16.9	17.0	17.5	17.9	17.4	17.4	18.4	20.1	20.7	21.5	20.4	19.5	19.1	20.1	19.4	19.7	19.9	18.8	19.3	18.5	18.8	18.5	18.9
Norfolk, Va	12.0	12.2	12.0	11.7	11.3	11.6	11.2	11.1	11.7	12.4	13.2	12.9	13.5	14.1	14.1	14.3	14.2	12.5	11.9	11.9	12.4	12.4	12.5	11.7	12.5
Northfield, Vt	9.7	9.3	9.1	8.6	7.3	8.0	7.7	8.1	10.3	11.1	11.2	12.5	12.8	13.6	12.9	12.4	11.8	11.5	9.9	9.0	9.8	9.4	9.2	9.1	10.2
North Platte, Nebr	11.3	10.7	9.9	9.7	9.1	9.2	9.3	9.4	8.6	9.6	10.1	10.6	11.3	12.2	12.6	13.9	14.4	15.1	14.0	13.2	12.1	11.8	11.4	10.9	11.3
Oklahoma, Okla	13.3	13.1	13.4	12.7	13.4	14.4	14.2	13.6	15.0	16.6	18.9	19.1	19.0	18.7	18.1	17.8	17.5	16.9	15.2	12.7	12.2	12.5	13.1	13.5	15.2
Omaha, Nebr	8.5	9.6	9.5	9.4	9.5	9.4	9.1	9.7	10.1	10.9	11.2	10.9	11.8	11.7	12.0	12.0	12.4	11.5	9.8	9.5	8.9	8.5	8.7	8.6	10.1
Oswego, N. Y	15.6	15.7	15.4	15.7	15.4	15.3	14.2	15.0	15.6	16.0	15.8	15.0	15.9	16.0	15.9	16.1	15.8	15.2	13.8	14.9	15.0	14.7	14.7	15.3	15.3
Palestine, Tex	9.3	9.5	9.5	9.3	9.5	9.6	9.5	9.7	9.8	11.8	12.9	12.9	13.0	13.1	13.1	13.0	13.2	12.9	11.7	9.5	8.7	9.8	9.7	9.5	10.9
Parkersburg, W. Va	9.0	8.1	8.1	8.5	7.5	7.1	7.6	8.1	8.6	9.1	9.5	9.8	10.1	10.5	11.1	10.5	10.0	9.9	9.4	8.0	7.8	7.9	8.9	9.6	9.0
Pensacola, Fla	9.0	9.3	9.6	8.7	8.7	8.8	9.2	9.0	9.5	10.3	10.7	11.6	11.5	11.7	11.0	12.8	12.5	11.8	10.7	9.6	9.0	9.5	10.2	10.5	10.2
Phenix, Ariz	3.8	4.6	4.5	4.2	4.5	4.3	5.0	5.0	4.7	5.0	5.7	5.4	5.1	5.5	5.5	6.4	6.8	6.8	7.1	5.8	4.2	3.6	3.4	3.2	5.0
Philadelphia, Pa	11.3	10.6	11.0	10.6	11.1	10.7	11.1	11.7	12.3	12.5	13.3	13.4	14.1	13.9	14.5	13.8	13.4	13.1	12.8	11.8	11.7	11.3	11.1	11.4	12.2
Pierre, S. Dak	12.7	12.2	12.3	11.6	10.6	10.7	11.2	10.8	10.1	11.2	12.2	12.8	13.4	13.1	13.3	13.9	14.3	14.5	14.6	13.3	13.4	14.6	13.3	12.6	12.6
Pittsburg, Pa	7.3	7.1	6.8	6.2	6.0	6.2	6.4	6.7	7.2	7.9	7.5	7.2	7.6	7.7	7.4	7.1	6.9	7.2	6.7	6.5	6.6	6.8	6.6	6.9	6.9
Point Reyes Lt., Cal	14.9	15.1	15.9	15.8	17.0	17.4	19.0	18.9	19.1	19.9	20.6	19.6	20.3	19.5	19.1	18.9	17.8	16.1	16.8	15.6	15.2	14.8	14.7	14.5	17.4
Port Crescent, Wash.	3.6	3.9	3.6	4.1	3.0	2.7	2.5	2.8	3.4	3.2	3.0	3.5	4.4	5.4	6.2	6.4	7.3	6.9	6.3	6.2	5.0	3.8	3.9	3.4	4.3
Port Huron, Mich	13.1	13.5	13.3	15.4	13.0	13.5	13.4	13.6	13.9	14.4	14.3	13.9	14.3	14.5	14.4	14.7	14.4	14.1	13.2	12.8	13.0	13.4	12.8	13.0	13.7
Portland, Me	7.9	8.2	8.0	8.3	8.3	8.4	9.0	8.9	9.5	10.0	9.6	8.8	9.3	10.0	9.6	10.0	9.2	8.7	8.0	7.8	8.5	7.7	8.1	8.1	8.7
Portland, Oreg	9.7	9.8	9.6	8.4	8.0	8.5	7.5	6.9	7.8	8.7	9.2	8.8	8.8	10.1	10.1	10.6	11.4	11.0	10.9	10.3	10.2	10.6	9.2	9.5	9.4
Pueblo, Colo	5.9	5.5	5.5	5.3	5.0	5.3	5.9	6.2	7.2	8.1	9.1	10.0	11.1	12.8	14.1	14.3	15.1	15.4	15.7	13.3	10.6	8.0	7.4	7.5	9.3
Raleigh, N. C	6.9	7.4	7.3	7.1	7.1	6.5	6.5	7.1	7.7	8.8	9.5	9.7	10.2	10.7	10.5	9.9	9.3	8.1	6.6	6.4	6.7	7.5	8.1	7.8	8.1
Rapid City, S. Dak	6.5	6.7	6.5	6.4	6.2	6.1	6.7	6.8	6.8	6.8	7.8	8.8	10.0	10.6	11.7	12.4	12.8	12.6	12.2	10.5	8.0	6.8	6.5	6.1	8.4
Red Bluff, Cal	7.4	6.7	6.7	6.7	7.4	7.0	7.1	6.9	7.3	6.7	7.1	8.0	9.2	9.7	9.5	9.3	9.7	10.8	10.4	10.7	9.4	7.7	7.7	6.6	8.1
Richmond, Va	6.4	6.7	6.3	7.2	6.5	6.1	6.2	6.7	8.0	10.1	9.7	9.8	10.3	10.6	11.4	10.9	10.7	9.5	8.0	7.9	7.8	7.2	7.5	7.0	8.3
Rochester, N. Y	10.2	9.5	9.9	9.7	9.9	10.1	9.5	9.6	10.3	10.3	11.3	11.1	11.8	11.9	12.6	12.6	11.9	11.5	11.2	11.0	11.2	10.5	10.7	10.1	10.8
Roseburg, Oreg	2.8	2.7	2.4	2.7	2.3	2.5	2.5	2.7	2.9	2.8	3.4	4.0	3.6	4.1	4.9	5.5	5.8	6.4	6.2	6.2	5.6	3.7	3.2	3.1	3.8
Sacramento, Cal	10.6	10.2	9.9	9.6	10.0	9.9	10.3	10.0	9.9	9.7	10.1	10.7	12.0	12.3	13.0	12.6	13.6	12.8	13.4	13.0	12.9	12.2	11.9	10.7	11.3
St. Louis, Mo	12.3	11.9	12.0	12.1	11.4	10.9	11.1	12.4	12.3	12.2	12.8	12.9	12.8	13.3	14.0	13.8	14.3	13.8	13.5	12.7	13.3	13.1	13.6	13.0	12.7
St. Paul, Minn	7.7	7.4	7.3	7.0	7.1	7.0	7.7	8.0	8.2	8.7	9.4	10.2	10.3	10.6	11.1	11.4	10.7	10.5	9.0	7.9	7.6	8.1	8.1	8.0	8.7
Salt Lake City, Utah.	5.3	5.5	5.5	5.6	5.3	4.8	4.9	4.7	5.1	5.2	6.0	6.9	8.3	9.5	10.6	10.5	10.4	10.0	10.0	7.4	6.2	5.4	4.8	4.9	6.8
San Antonio, Tex	10.9	9.7	8.7	8.4	8.3	7.8	8.3	8.5	8.9	10.7	13.0	13.4	14.0	13.8	13.9	14.1	14.3	14.3	14.0	13.9	13.3	13.0	12.5	11.2	11.6
San Diego, Cal	3.8	4.3	4.1	4.3	4.4	4.6	4.8	4.6	4.2	4.4	4.5	5.4	6.7	8.8	10.9	11.5	11.7	11.6	11.5	9.8	7.7	5.6	4.6	3.9	6.6
Sandusky, Ohio	10.4	10.2	10.6	10.4	10.3	9.6	10.3	10.4	10.2	10.5	11.5	10.8	10.5	10.9	11.0	11.2	10.5	10.5	10.3	10.8	11.5	11.0	11.2	11.0	10.6
Sandy Hook, N. J	12.4	12.2	11.5	11.8	11.3	11.8	12.5	11.9	11.9	11.8	11.9	11.0	11.4	10.5	9.9	10.3	10.9	10.4	10.5	10.8	11.0	11.8	11.4	11.7	11.4
San Francisco, Cal	7.9	7.8	7.8	7.9	7.4	7.3	7.6	7.3	7.4	7.6	8.3	9.1	10.0	9.9	10.6	11.3	13.6	14.1	14.2	14.1	13.0	12.0	10.6	9.2	9.8
San Luis Obispo, Cal.	4.5	4.1	5.3	5.1	4.6	4.8	4.6	4.5	4.8	5.1	5.2	6.8	6.5	7.2	8.3	10.2	10.5	10.8	10.5	9.9	8.8	6.7	5.3	4.5	6.6
Santa Fe, N. Mex	6.0	5.8	5.7	5.5	4.9	4.3	4.5	4.0	3.7	5.5	7.9	9.6	10.4	12.0	13.0	13.0	13.9	13.8	12.7	11.3	7.3	5.9	5.7	6.1	8.0
Sault Ste. Marie, Mich	9.4	8.5	8.9	8.7	8.5	8.3	8.0	7.8	8.1	8.9	9.9	11.9	13.7	15.1	15.2	16.5	16.4	16.3	15.6	13.4	11.9	11.2	10.7	9.7	11.4
Savannah, Ga	9.2	8.6	8.1	7.9	7.5	7.8	7.7	7.9	8.9	10.7	11.6	12.6	13.1	13.4	13.6	13.8	13.9	12.7	11.0	10.6	10.5	10.0	10.4	9.7	10.5
Seattle, Wash	5.7	5.6	5.6	5.2	5.5	5.4	6.3	6.3	6.1	6.5	6.7	7.4	8.2	8.5	8.9	9.0	9.5	9.3	8.8	8.5	7.5	6.1	5.7	5.1	7.0
Shreveport, La	9.8	9.3	8.7	8.3	8.5	7.8	7.9	8.3	8.6	10.4	11.0	10.5	11.4	11.6	12.0	13.0	13.8	13.2	11.9	10.2	10.0	10.4	11.0	10.8	10.4
Sioux City, Iowa	12.6	12.5	13.1	13.6	14.2	15.7	15.4	15.4	15.6	15.9	16.1	16.2	16.3	16.6	16.5	16.5	16.6	14.9	13.8	13.0	12.1	12.7	13.3	12.9	14.6
Spokane, Wash	7.1	7.8	8.3	7.8	7.2	6.3	6.3	6.0	6.1	6.0	6.4	7.1	8.2	8.4	9.1	9.5	9.5	9.6	9.4	8.5	7.0	6.2	6.2	6.1	7.5
Springfield, Ill	12.4	12.0	11.1	10.8	11.2	11.1	11.7	11.3	12.0	12.3	12.3	12.3	13.2	14.3	14.3	14.7	14.8	14.5	13.9	12.5	12.5	12.7	12.5	12.1	12.6
Springfield, Mo	13.1	12.6	12.5	12.8	13.2	13.3	13.7	13.7	14.0	14.7	15.8	15.8	16.6	16.9	17.6	18.4	18.4	17.5	16.1	14.1	13.1	13.0	13.3	13.6	14.7
Tacoma, Wash	7.5	7.4	7.1	7.1	7.5	7.0	7.1	7.2	6.7	7.2	7.1	7.3	8.3	9.8	10.8	11.0	10.5	10.3	9.3	9.4	9.5	8.9	7.9	7.5	8.3
Tampa, Fla	5.4	5.4	5.5	5.8	5.8	6.0	5.5	6.6	7.9	8.7	9.0	9.5	9.9	10.1	10.7	10.9	10.6	9.3	7.2	5.7	5.6	5.4	5.0	5.6	7.4
Toledo, Ohio	11.5	11.3	11.7	11.3	10.7	11.0	11.2	11.8	12.3	12.3	12.7	12.7	12.4	13.0	13.5	13.4	12.8	12.2	12.4	12.4	12.3	12.7	12.7	12.2	12.2
Vicksburg, Miss	11.1	10.4	10.4	10.1	10.8	10.4	10.7	10.3	10.5	10.9	11.2	11.6	12.6	12.7	12.1	12.0	12.4	11.4	10.2	9.1	9.4	9.8	10.8	11.6	10.9
Vineyard Haven, Mass	10.7	10.4	10.5	11.0	11.5	11.9	12.5	13.1	13.3	13.4	12.9	13.3	13.4	13.3	12.9	12.8	12.5	11.8	11.4	11.6	11.5	10.4	10.4	10.2	11.9
Walla Walla, Wash	7.1	6.9	6.4	6.3	5.6	5.5	5.4	5.8	5.3	5.4	6.0	6.7	8.3	8.2	8.7	9.1	8.8	8.4	8.7	8.0	7.6	6.4	6.9	7.1	7.0
Washington, D. C	8.7	8.1	8.1	7.3	8.2	8.3	8.0	8.7	10.1	11.4	10.6	11.5	11.8	12.7	12.8	12.6	12.5	11.6	9.9	8.4	8.6	9.2	8.6	8.6	9.8
Wichita, Kans	10.5	10.5	10.7	11.2	11.2	10.8	11.9	12.1	12.4	13.4	14.7	14.8	15.0	15.5	14.8	14.1	13.6	12.9	11.7	9.5	8.4	9.0	9.3	9.7	12.0
Williston, N. Dak	6.8	6.7	7.2	7.9	7.6	7.5	7.3	7.1	6.4	6.7	8.0	9.2	12.3	12.5	13.2	13.5	13.1	12.2	12.3	10.5	8.4	7.9	7.8	6.9	9.1
Wilmington, N. C	10.1	10.5	10.6	9.9	9.6	9.3	8.7	9.1	9.8	11.2	12.4	13.0	13.8	15.0	15.1	14.9	14.7	12.8	11.5	10.2	10.0	9.6	9.9	9.7	11.3
Winnemucca, Nev	9.8	10.2	10.1	10.0	10.0	9.7	9.5	8.7	9.5	9.3	10.1	10.8	12.5	13.3	14.6	15.7	15.6	15.5	15.4	14.8	12.4	10.4	9.2	9.9	11.5
Woods Hole, Mass	17.2	17.1	16.9	17.4	17.2	17.4	17.5	18.5	18.5	17.7	16.8	17.3	17.7	17.3	17.2	17.3	17.5	17.1	16.6	16.7	17.3	16.5	15.9	16.7	17.2
Yankton, S. Dak	8.8	8.6	9.6	10.2	9.7	9.5	9.5	9.1	9.2	9.7	10.6	11.2	11.8	12.0	12.1	12.2	11.8	10.9	10.0	9.1	8.2	8.2	8.3	8.2	9.9
West Indies.																									
Basseterre, St. Kitts	8.9	9.0	8.9	8.7	9.0	9.2	9.0	10.3	11.7	11.9	11.9	11.6	11.1	11.3	11.6	10.9	9.7	9.1	8.7	8.9	9.3	9.0	9.1	9.3	9.9
Bridgetown, Bar	4.5	4.7	5.1	4.3	4.6	4.8	6.0	9.0	9.8	10.8	10.8	10.6	10.4	10.2	10.2	9.5	8.3	6.2	5.0	4.6	4.7	4.9	5.2	4.6	7.0
Colon, U. S. C	7.4	7.2	7.5	7.4	7.1	6.9	6.3	6.4	6.8	7.1	7.8	8.3	9.2	9.6	9.5	9.4	8.8	8.2	7.7	7.9	7.5	7.2	7.5	7.3	7.7
Havana, Cuba	5.8	5.8	5.2	5.2	5.3	5.5	5.8	5.9	6.6	8.7	9.7	11.0	13.4	15.0	15.8	16.5	16.0	14.7	12.2	10.3	8.6	7.0	6.1	5.9	9.2
Kingston, Jamaica	5.2	5.2	5.3	5.4	5.1	5.3	4.7	4.1	4.1	7.3	10.8	13.4	15.2	15.1	14.3	13.0	11.1	8.6	5.7	4.1	4.2	4.4	4.8	4.7	7.5
Port of Spain, Trin'd.	1.8	2.1	1.8	2.0	1.9	2.0	2.3	4.4	6.6	7.6	7.9	8.1	8.0	8.0	7.9	8.0	7.0	5.1	3.8	2.9	2.5	2.4	2.3	2.2	4.5
San Juan, Porto Rico.	4.5	4.4	4.4	3.9	3.9	3.7	3.4	4.5	6.7	8.9	10.4	11.2	11.7	11.6	11.5	10.7	9.7	9.0	7.8	7.2	6.3	5.3	5.1	4.5	7.1
Santiago de Cuba	2.8	2.7	2.8	2.7	2.5	2.6	2.8	3.1	4.7	6.1	7.0	8.2	9.8	9.8	9.9	9.3	8.3	6.3	4.0	3.2	3.7	3.6	3.2	3.0	5.1
Willemstad, Curaçao.	10.0	10.1	9.9	9.8	9.7	9.5	10.5	13.3	14.5	15.2	15.8	15.8	15.3	15.1	15.0	14.2	14.1	12.7	11.4	11.7	11.3	11.1	11.1	10.6	12.4

TABLE VI.—*Resultant winds from observations at 8 a. m. and 8 p. m., daily, during the month of March, 1899.*

Stations.	Component direction from— N.	S.	E.	W.	Resultant. Direction from—	Duration.
	Hours.	Hours.	Hours.	Hours.	°	Hours.
New England.						
Eastport, Me	21	11	29	24	n. 27 e.	11
Portland, Me	24	16	12	22	n. 51 w.	13
Northfield, Vt	21	32	5	13	s. 36 w.	14
Boston, Mass	19	12	17	26	n. 52 w.	11
Nantucket, Mass	21	18	17	22	n. 59 w.	6
Woods Hole, Mass.*	11	8	8	13	n. 59 w.	6
Block Island, R. I	21	19	17	19	n. 45 w.	3
New Haven, Conn	32	12	11	18	n. 19 w.	21
Middle Atlantic States.						
Albany, N. Y	31	12	9	21	n. 32 w.	22
Binghamton, N. Y.†	12	7	7	10	n. 31 w.	6
New York, N. Y	25	10	21	24	n. 11 w.	15
Harrisburg, Pa.†	14	4	11	8	n. 17 e.	10
Philadelphia, Pa	31	12	19	19	n.	19
Atlantic City, N. J	19	18	15	22	n. 82 w.	7
Cape May, N. J	18	18	18	20	w.	2
Baltimore, Md	17	18	21	19	s. 63 e.	2
Washington, D. C	22	19	16	16	n.	3
Lynchburg, Va	19	17	13	26	n. 81 w.	13
Norfolk, Va	15	25	19	17	s. 11 e.	10
Richmond, Va	19	24	16	15	s. 11 e.	5
South Atlantic States.						
Charlotte, N. C	16	28	17	19	s. 9 w.	12
Hatteras, N. C	14	27	14	16	s. 9 w.	13
Raleigh, N. C	19	20	10	28	s. 87 w.	18
Wilmington, N. C	13	26	15	26	s. 40 w.	17
Charleston, S. C	9	29	11	22	s. 29 w.	23
Augusta, Ga	14	23	12	33	s. 67 w.	23
Savannah, Ga	15	31	8	23	s. 43 w.	22
Jacksonville, Fla	11	30	19	19	s.	19
Florida Peninsula.						
Jupiter, Fla	14	30	20	14	s. 21 e.	17
Key West, Fla	15	19	34	5	s. 82 e.	29
Tampa, Fla	16	22	15	26	s. 61 w.	12
Eastern Gulf States.						
Atlanta, Ga	12	26	13	29	s. 49 w.	21
Pensacola, Fla	15	32	16	17	s. 3 w.	17
Mobile, Ala	17	35	10	9	s. 3 e.	19
Montgomery, Ala	15	30	14	16	s. 8 w.	15
Meridian, Miss.†	12	14	7	8	s. 27 w.	2
Vicksburg, Miss	16	27	23	13	s. 42 w.	15
New Orleans, La	14	34	13	14	s. 3 w.	20
Western Gulf States.						
Shreveport, La	15	24	26	15	s. 51 e.	14
Fort Smith, Ark	14	11	25	18	n. 67 e.	8
Little Rock, Ark	16	21	20	21	s. 11 w.	5
Corpus Christi, Tex	12	31	34	0	s. 61 e.	39
Fort Worth, Tex†	9	12	4	11	s. 67 w.	8
Galveston, Tex	12	30	27	11	s. 42 e.	24
Palestine, Tex	18	31	7	19	s. 43 w.	18
San Antonio, Tex	23	24	24	4	s. 87 e.	20
Ohio Valley and Tennessee.						
Chattanooga, Tenn	17	22	18	22	s. 39 w.	6
Knoxville, Tenn	17	19	16	26	s. 79 w.	10
Memphis, Tenn	19	27	14	18	s. 27 w.	10
Nashville, Tenn	18	24	12	20	s. 53 w.	10
Lexington, Ky.†	9	13	7	11	s. 45 w.	6
Louisville, Ky	19	18	13	21	n. 83 w.	8
Evansville, Ind.†	11	9	10	7	n. 56 e.	4
Indianapolis, Ind	25	15	17	21	n. 22 w.	11
Cincinnati, Ohio	21	18	14	23	n. 72 w.	10
Columbus, Ohio	15	20	14	28	s. 70 w.	15
Pittsburg, Pa	23	20	13	23	n. 73 w.	10
Parkersburg, W. Va	19	21	12	25	s. 81 w.	13
Elkins, W. Va	16	24	9	27	s. 72 w.	19
Lower Lake Region.						
Buffalo, N. Y	12	17	20	25	s. 45 w.	7
Oswego, N. Y	13	22	23	18	s. 29 e.	10
Rochester, N. Y	11	17	18	28	s. 59 w.	12
Erie, Pa	17	15	16	26	n. 79 w.	10
Cleveland, Ohio	17	17	17	22	w.	5
Sandusky, Ohio	17	12	21	24	n. 31 w.	6
Toledo, Ohio	15	11	17	27	n. 68 w.	11
Detroit, Mich	22	10	18	25	n. 30 w.	14
Upper Lake Region.						
Alpena, Mich	15	8	14	37	n. 73 w.	24
Escanaba, Mich	33	12	13	17	n. 11 w.	21
Grand Haven, Mich	28	6	22	16	n. 15 e.	22
Marquette, Mich	32	9	9	23	n. 31 w.	27
Port Huron, Mich	22	13	17	22	n. 29 w.	10
Sault Ste. Marie, Mich	14	2	21	31	n. 40 w.	16
Chicago, Ill	25	13	19	18	n. 5 e.	12
Milwaukee, Wis	31	7	18	21	n. 7 w.	24
Green Bay, Wis	32	13	10	20	n. 28 w.	22
Duluth, Minn	32	5	15	26	n. 22 w.	29
North Dakota.						
Moorhead, Minn	30	12	15	28	n. 36 w.	22
Bismarck, N. Dak	31	9	19	20	n. 3 w.	22
Williston, N. Dak	31	14	9	16	n. 22 w.	18
Upper Mississippi Valley.						
St. Paul, Minn	27	6	13	31	n. 41 w.	28
La Crosse, Wis. †	13	10	6	12	n. 63 w.	7
Davenport, Iowa	26	8	19	24	n. 16 w.	19
Des Moines, Iowa	33	12	19	11	n. 21 e.	22
Dubuque, Iowa	30	9	14	29	n. 35 w.	26
Keokuk, Iowa	28	10	19	21	n. 6 w.	18
Cairo, Ill	23	19	14	18	n. 45 w.	6
Springfield, Ill	26	20	12	18	n. 45 w.	8
Hannibal, Mo. †	14	6	7	10	n. 21 w.	6
St. Louis, Mo	18	16	17	21	n. 63 w.	4
Missouri Valley.						
Columbia, Mo.*	12	6	8	8	n.	6
Kansas City, Mo	32	10	20	21	n. 3 w.	22
Springfield, Mo	22	21	16	14	n. 63 e.	2
Lincoln, Nebr	34	10	20	9	n. 25 e.	26
Omaha, Nebr	32	11	14	20	n. 16 w.	22
Sioux City, Iowa†	16	6	9	11	n. 18 w.	6
Pierre, S. Dak	29	9	24	18	n. 17 e.	21
Huron, S. Dak	27	13	17	22	n. 20 w.	15
Yankton, S. Dak †	14	3	9	12	n. 15 w.	11
Northern Slope.						
Havre, Mont	22	12	16	29	n. 52 w.	16
Miles City, Mont	27	9	7	28	n. 49 w.	28
Helena, Mont	21	18	3	34	n. 84 w.	31
Rapid City, S. Dak	30	12	17	24	n. 21 w.	19
Cheyenne, Wyo	26	12	5	31	n. 62 w.	30
Lander, Wyo	16	21	16	26	s. 63 w.	11
North Platte, Nebr	23	17	13	23	n. 59 w.	12
Middle Slope.						
Denver, Colo	25	17	17	21	n. 27 w.	9
Pueblo, Colo	21	9	19	25	n. 27 w.	13
Concordia, Kans	27	13	20	10	n. 36 e.	17
Dodge, Kans	31	16	19	13	n. 22 e.	16
Wichita, Kans	28	22	15	9	n. 45 e.	8
Oklahoma, Okla	25	20	14	10	n. 39 e.	6
Southern Slope.						
Abilene, Tex	19	26	16	20	s. 30 w.	8
Amarillo, Tex	20	23	10	18	s. 69 w.	8
Southern Plateau.						
El Paso, Tex	23	7	10	40	n. 62 w.	34
Santa Fe, N. Mex	20	21	11	27	s. 87 w.	16
Flagstaff, Ariz	14	22	6	39	s. 76 w.	34
Phenix, Ariz	13	10	21	28	n. 67 w.	8
Yuma, Ariz	20	10	11	30	n. 62 w.	22
Independence, Cal	24	17	6	31	n. 74 w.	26
Middle Plateau.						
Carson City, Nev	17	23	9	30	s. 74 w.	22
Winnemucca, Nev	8	37	9	20	s. 21 w.	31
Salt Lake City, Utah	18	21	16	20	s. 53 w.	5
Grand Junction, Colo	17	12	22	21	n. 11 e.	5
Northern Plateau.						
Baker City, Oreg	24	22	12	22	n. 79 w.	10
Boise, Idaho	16	18	20	26	s. 72 w.	6
Idaho Falls, Idaho	17	39	2	9	s. 18 w.	23
Spokane, Wash	11	28	17	19	s. 7 w.	17
Walla Walla, Wash	7	43	7	13	s. 10 w.	36
North Pacific Coast Region.						
Fort Canby, Wash	18	12	14	28	n. 67 w.	15
Neah, Wash	2	9	15	41	s. 75 w.	27
Port Crescent, Wash.*	0	1	15	16	s. 45 w.	1
Seattle, Wash	16	28	19	14	s. 23 e.	13
Tacoma, Wash	15	26	9	26	s. 57 w.	20
Portland, Oreg	18	23	13	23	s. 63 w.	11
Roseburg, Oreg	23	15	21	21	n.	8
Middle Pacific Coast Region.						
Eureka, Cal	22	24	15	18	s. 6 w.	4
Mount Tamalpais, Cal	15	16	8	37	s. 88 w.	29
Red Bluff, Cal	20	25	18	11	s. 54 e.	9
Sacramento, Cal	15	35	15	15	s.	20
San Francisco, Cal	4	25	7	37	s. 55 w.	37
South Pacific Coast Region.						
Fresno, Cal	27	11	16	29	n. 39 w.	21
Los Angeles, Cal	12	15	9	38	s. 84 w.	29
San Diego, Cal	27	8	15	28	n. 34 w.	23
San Luis Obispo, Cal	25	19	4	20	n. 69 w.	17
West Indies.						
Basseterre, St. Kitts Island	23	1	52	0	n. 67 e.	57
Bridgetown, Barbados	30	0	50	0	n. 59 e.	58
Colon, U. S. C	44	3	31	3	n. 34 e.	50
Havana, Cuba	17	10	41	4	n. 81 e.	38
Kingston, Jamaica	39	7	27	2	n. 38 e.	41
Port of Spain, Trinidad	16	7	45	3	n. 78 e.	43
San Juan, Porto Rico	1	34	39	4	s. 47 e.	48
Santiago de Cuba, Cuba	24	19	14	9	n. 45 e.	7
Willemstad, Curaçao	7	0	59	0	n. 83 e.	58

*From observations at 8 p. m. only. †From observations at 8 a. m. only.

TABLE VII.—*Thunderstorms and auroras, March, 1899.*

States.	No. of stations.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total. No.	Total. Days.	
Alabama	53	T.				9	1						2	4	1	3	3	1		9	3		1	1	2			1	6		5	2		54	17	T.
		A.																																0	0	A.
Arizona	53	T.																2										1	1					4	3	T.
		A.																																0	0	A.
Arkansas	57	T.			7	6									1	3			15	15		2	2					5	12	2		2	1	73	13	T.
		A.																																0	0	A.
California	189	T.												1	2			3		1						1		1		6				15	7	T.
		A.																																0	0	A.
Colorado	73	T.	2		1																				1		7	1	1	1		1		15	8	T.
		A.																																0	0	A.
Connecticut	22	T.					14							13																				27	2	T.
		A.																																0	0	A.
Delaware	5	T.					2							2							1													5	3	T.
		A.																																0	0	A.
Dist. of Columbia	4	T.				1	1														1													3	3	T.
		A.																																0	0	A.
Florida	45	T.				1	7	1							2			1	2	1	3	1			9	1			1	1	1	6	7	45	16	T.
		A.																																0	0	A.
Georgia	54	T.		4		10	5	1							2	2	4			9	3			7	5		2	1	1	13	1	2	2	74	18	T.
		A.																																0	0	A.
Idaho	27	T.	1																			1												2	2	T.
		A.																																0	0	A.
Illinois	92	T.	2		24	3							5			2	1	1	8	18			3	6		2	3	4	7					89	15	T.
		A.																																0	0	A.
Indiana	55	T.	4	17	4	1							1				1	4		14				14					5	2				67	11	T.
		A.																																0	0	A.
Indian Territory	8	T.																	1										1					2	2	T.
		A.																																0	0	A.
Iowa	126	T.									1	8	5	1	1	17	1		24								1							59	9	T.
		A.						1			1																							2	2	A.
Kansas	74	T.			1							7	9			3			10	3			1					1						35	8	T.
		A.																																0	0	A.
Kentucky	45	T.	3	5	24	22	3						2	2		2	2		1	14	2		9	13	2	1	2	7	13	9		1		139	21	T.
		A.																																0	0	A.
Louisiana	45	T.				3	1							6	9	5		1	4	6	1								2	5		1	1	45	13	T.
		A.																																0	0	A.
Maine	17	T.					3																											3	1	T.
		A.										2											1											3	2	A.
Maryland	39	T.				17	16					1		20	2		5			2	14			2			1	1	2	20		1		104	14	T.
		A.								1																								1	1	A.
Massachusetts	54	T.			1	1	29						1	23	1				1		2										4			63	9	T.
		A.																																0	0	A.
Michigan	107	T.										11		1			2							9										23	4	T.
		A.																																0	0	A.
Minnesota	64	T.									4	14				2																		20	3	T.
		A.						1																										1	1	A.
Mississippi	42	T.				10							4	5	6	8	3		5	11				1					2	7		9	1	72	13	T.
		A.																																0	0	A.
Missouri	89	T.		2	7	1						1	9	2		3		1	25	11	2		2			2	2	9	5			1	1	86	18	T.
		A.																																0	0	A.
Montana	37	T.																																0	0	T.
		A.		2	1					1	1	2		1			1							1										10	8	A.
Nebraska	145	T.										3	2			2			12						1									20	5	T.
		A.																														1		1	1	A.
Nevada	45	T.	1															1									1							3	3	T.
		A.																																0	0	A.
New Hampshire	20	T.			1		2							8							1	1												13	5	T.
		A.						2																										2	1	A.
New Jersey	50	T.		1		2	23							23						1	3			5	5		1	1		2				67	11	T.
		A.																																0	0	A.
New Mexico	38	T.																										1						1	1	T.
		A.																																0	0	A.
New York	103	T.					7							22	1		3								2									35	5	T.
		A.						1		1																								2	2	A.
North Carolina	56	T.		20	29	14	9	2	2							3	2			12	10	1	1	1	1			11	11	28	2	1	6	166	20	T.
		A.																																0	0	A.
North Dakota	40	T.																																0	0	T.
		A.		1				1									1						4									1		8	5	A.
Ohio	134	T.			25	16	3	1	1			1	1		1			16	1	28		2	1	52	8	1	5	1	3	4		1		172	21	T.
		A.											1							1		1				1	1							5	5	A.
Oklahoma	22	T.										2	6		1			1				1												11	5	T.
		A.																																0	0	A.
Oregon	71	T.								2																								2	1	T.
		A.																																0	0	A.
Pennsylvania	100	T.				9	11							16			12				9			1			2	2		2				64	9	T.
		A.																																0	0	A.
Rhode Island	8	T.					4							2							1									1				8	4	T.
		A.																																0	0	A.
South Carolina	44	T.		5	5	6	9						1		2	4	1			6	4			2	3		1	4	2	14		2	6	77	18	T.
		A.																																0	0	A.
South Dakota	52	T.																																0	0	T.
		A.																					1											1	1	A.
Tennessee	61	T.	1	12	16	27	2							1	6	2		4	18	3		3	15	3		2	8	12	16		3	2		156	20	T.
		A.																																0	0	A.
Texas	83	T.			1								1			1		3	3	2									3	4				18	8	T.
		A.																																0	0	A.
Utah	34	T.													1			1	1				2			1	1				2			9	7	T.
		A.																																0	0	A.
Vermont	14	T.												3																				3	1	T.
		A.						1																										1	1	A.
Virginia	47	T.		16	18	22	14	2						2			2			2	8					1		2	11	12				112	13	T.
		A.																																0	0	A.
Washington	55	T.								2		1																						3	2	T.
		A.																					1											1	1	A.
West Virginia	38	T.		2	5	8	1										2							5					4	9				36	8	T.
		A.																																0	0	A.
Wisconsin	60	T.										11	6			5			1															23	4	T.
		A.						1						1																				2	2	A.
Wyoming	18	T.																1		1														2	2	T.
		A.																														1		1	1	A.
Sums	2,804	T.	14	84	169	179	167	7	3	4	5	60	55	157	39	67	44	41	132	169	68	12	37	122	39	12	37	66	119	142	18	32	25	2,125	....	T.
		A.	0	3	1	0	0	8	0	3	2	4	1	2	0	0	2	0	0	1	0	1	7	1	0	1	1	0	0	0	0	3	0	41	....	A.

TABLE VIII.—*Average hourly sunshine (in percentages), March, 1899.*

Stations.	Instrument.	Percentages for each hour of local mean time ending with the respective hour.																Hours of sunshine.			
		A. M.								P. M.								Total.			Personal estimate.
		5	6	7	8	9	10	11	Noon	1	2	3	4	5	6	7	8	Actual.	Possible.	Percent of possible.	
																		Hours.	*Hours.*		
Albany, N. Y	T.	......	29	20	23	31	48	59	55	61	58	58	63	50	28	30	......	172.2	370.9	46	26
Atlanta, Ga	T.	......	40	31	30	34	38	47	56	60	64	58	55	48	36	36	......	173.0	372.3	46	46
Atlantic City, N. J	P.	......	58	48	47	46	41	44	37	43	45	51	52	50	42	57	......	169.7	371.4	46	32
Baltimore, Md	T.	......	42	43	47	58	79	84	87	90	90	90	83	70	61	61	......	274.0	371.4	74	35
Binghamton, N. Y	T.	......	15	10	19	36	44	46	58	59	54	51	37	25	17	2	......	140.3	370.8	38	21
Bismarck, N. Dak	P.	......	69	50	51	56	61	63	62	59	56	52	48	46	25	31	......	196.7	370.3	53	45
Boise, Idaho	P.	......	40	33	37	41	49	57	52	47	53	47	45	44	39	38	......	168.4	370.7	45	35
Boston, Mass	T.	......	31	39	41	41	39	38	48	54	52	51	48	40	39	24	......	163.3	370.8	44	39
Buffalo, N. Y.*	T.	......	62	22	26	28	40	45	53	52	50	29	23	20	8	0	......	85.9	260.1	33	22
Charleston, S. C	T.	......	33	30	35	52	52	62	77	70	85	80	74	54	42	26	......	221.0	372.3	59	56
Chattanooga, Tenn	T.	......	60	29	25	33	38	47	53	54	50	49	44	41	31	34	......	154.1	372.1	41	38
Cheyenne, Wyo	P.	......	33	40	59	69	69	65	64	69	75	74	71	59	37	9	......	230.9	371.2	62	32
Chicago, Ill	T.	......	0	17	17	30	42	48	45	51	42	37	32	16	13	7	......	119.9	370.8	32	26
Cincinnati, Ohio	T.	......	33	25	22	32	46	57	55	58	57	53	55	45	39	37	......	168.4	371.4	45	33
Cleveland, Ohio	T.	......	0	6	8	10	14	16	20	22	20	21	18	11	13	13	......	55.4	370.8	15	22
Columbia, Mo	T.	......	50	54	54	57	63	67	72	71	72	72	70	53	36	15	......	227.7	371.4	61	29
Columbus, Ohio	T.	......	33	28	24	18	22	39	43	42	21	25	17	17	20	11	......	96.7	371.2	26	29
Denver, Colo	P.	......	33	56	69	81	86	83	79	74	76	72	72	66	39	17	......	262.0	371.2	71	50
Des Moines, Iowa	T.	......	31	24	23	36	48	63	70	67	74	77	56	21	11	4	......	175.3	370.8	47	36
Detroit, Mich	T.	......	0	8	12	20	34	45	47	43	40	41	33	25	13	4	......	112.0	370.8	30	20
Dodge, Kans	P.	......	17	43	55	63	68	76	75	80	77	73	65	54	37	30	......	236.4	371.4	64	47
Dubuque, Iowa	T.	......	54	36	36	37	49	56	74	74	72	64	43	29	32	39	......	186.7	370.8	50	37
Eastport, Me	P.	......	38	31	29	35	47	51	48	47	46	43	37	28	23	27	......	143.8	370.7	39	26
Elkins, W. Va	T.	......	0	6	11	23	29	43	52	51	43	34	26	18	7	8	......	105.8	371.4	28	24
Erie, Pa	T.	......	0	2	5	12	20	29	38	50	37	25	19	23	29	28	......	90.9	370.8	25	24
Escanaba, Mich	T.	......	38	18	22	29	44	49	59	64	46	44	32	18	12	8	......	135.2	370.3	37	38
Eureka, Cal	P.	......	17	27	30	38	46	59	58	53	59	60	55	41	32	33	......	173.0	371.2	47	39
Fresno, Cal	T.	......	27	36	43	54	59	72	73	68	74	75	67	55	37	17	......	219.9	371.7	59	49
Galveston, Tex	P.	......	14	19	37	41	50	52	52	59	58	66	60	54	27	0	......	177.7	372.6	48	34
Grand Junction, Colo	P.	......	33	41	53	65	72	65	65	74	76	62	69	52	54	52	......	231.8	371.4	62	43
Harrisburg, Pa	T.	......	0	12	12	20	38	45	56	54	57	47	33	35	32	26	......	137.5	371.2	37	29
Helena, Mont	P.	......	25	29	42	54	58	63	61	69	66	63	56	45	39	46	......	199.8	370.3	54	35
Huron, S. Dak	T.	......	53	44	39	52	66	77	79	84	80	72	57	43	36	44	......	225.6	370.7	61	49
Idaho Falls, Idaho	T.	......	0	5	6	10	28	33	46	42	41	41	25	8	7	0	......	90.6	370.9	24	23
Indianapolis, Ind	T.	......	17	17	15	17	35	49	48	48	53	50	42	29	19	7	......	130.4	371.2	35	25
Jacksonville, Fla	T.	......	38	57	65	75	85	89	89	88	88	87	85	75	42	38	......	285.9	372.5	77	60
Kansas City, Mo.†	P.	......	50	43	36	39	38	41	37	34	36	44	47	46	44	39	......	145.5	359.7	40	34
Key West, Fla	T.	......	20	29	53	83	92	89	91	93	92	94	86	80	57	55	......	292.4	373.5	78	72
Knoxville, Tenn	T.	......	36	35	35	45	56	65	74	72	77	68	65	59	42	34	......	214.8	371.9	58	49
Lexington, Ky	T.	......	17	22	25	35	49	51	65	59	56	57	50	30	23	15	......	161.5	371.4	43	30
Little Rock, Ark	T.	......	20	32	42	48	58	70	72	76	71	72	67	58	44	32	......	220.7	372.1	59	45
Los Angeles, Cal	P.	......	30	43	55	62	65	66	71	67	69	76	76	69	57	34	......	240.3	372.3	65	51
Meridian, Miss	T.	......	33	30	54	63	83	88	89	91	91	90	87	71	51	48	......	275.8	372.1	74	51
Minneapolis, Minn	T.	......	25	22	24	36	50	58	61	68	59	52	45	23	16	14	......	158.9	370.7	43	......
Mount Tamalpais, Cal	P.	......	25	26	46	48	47	43	41	45	55	50	49	50	27	4	......	162.6	371.4	44	33
Nashville, Tenn	T.	......	12	17	18	27	36	46	58	66	65	55	51	37	22	13	......	154.9	371.9	42	29
New Orleans, La	T.	......	50	40	40	50	60	71	78	74	82	72	57	46	52	55	......	224.3	372.5	60	59
New York, N. Y	T.	......	0	14	25	31	43	50	50	50	55	56	57	40	21	11	......	152.2	371.2	41	31
Northfield, Vt	P.	......	40	26	22	28	34	41	41	39	43	43	42	34	23	19	......	128.3	370.7	35	25
Oklahoma, Okla	T.	......	50	44	48	58	73	77	81	82	90	91	90	82	66	43	......	273.2	372.1	73	65
Omaha, Nebr	P.	......	67	45	46	46	48	60	64	61	63	60	55	42	37	30	......	193.3	371.2	52	30
Parkersburg, W. Va	T.	......	8	4	11	31	35	44	55	56	44	39	31	18	13	11	......	118.7	371.4	32	29
Phenix, Ariz	P.	......	56	80	92	94	94	96	95	93	94	94	94	93	77	57	......	338.7	372.3	91	91
Philadelphia, Pa	T.	......	33	31	28	33	35	45	49	51	55	60	44	34	32	41	......	153.6	371.2	41	23
Pittsburg, Pa	T.	......	0	0	0	1	8	13	19	22	16	11	9	3	0	0	......	31.6	371.2	9	21
Portland, Me	T.	......	33	32	35	40	45	48	52	49	53	52	46	41	22	29	......	159.4	370.7	43	35
Portland, Oreg	T.	......	19	23	23	25	42	58	45	45	46	50	44	35	36	47	......	145.2	370.3	39	39
Raleigh, N. C	T.	......	36	27	25	41	62	65	64	70	62	54	55	44	32	34	......	186.7	371.9	50	52
Rochester, N. Y	T.	......	43	21	19	24	37	47	48	49	51	43	21	20	19	15	......	123.2	370.9	33	32
St. Louis, Mo	T.	......	50	28	33	52	57	65	65	68	67	65	53	39	26	20	......	191.5	371.4	52	36
St. Paul, Minn	P.	......	44	39	47	52	60	64	61	60	56	56	58	49	38	39	......	198.2	370.7	53	45
Salt Lake City, Utah	P.	......	0	12	23	37	43	44	38	30	44	47	53	43	37	22	......	140.0	371.2	38	33
San Diego, Cal	P.	......	22	49	57	60	66	79	86	89	86	89	90	85	79	60	......	284.7	372.3	76	73
San Francisco, Cal	T.	......	17	21	40	50	58	63	65	62	63	63	55	55	31	0	......	192.9	371.4	52	35
Santa Fe, N. Mex	P.	......	36	64	83	82	85	85	82	79	80	82	84	76	66	45	......	292.5	371.9	79	72
Savannah, Ga	T.	......	44	43	46	71	86	94	96	95	89	85	79	62	52	39	......	278.5	372.1	75	56
Seattle, Wash	T.	......	17	22	20	37	60	72	80	79	84	77	69	56	34	29	......	213.2	370.1	58	42
Spokane, Wash	T.	......	39	47	46	57	77	77	74	76	72	72	57	47	45	49	......	231.0	370.1	62	50
Tacoma, Wash	T.	......	25	26	26	36	55	66	67	73	77	65	58	38	34	29	......	191.9	370.3	52	33
Tampa, Fla	T.	......	0	58	58	59	73	83	88	90	83	80	70	65	61	52	......	268.5	372.8	72	67
Topeka, Kans	T.	......	42	34	39	52	60	68	66	72	73	69	65	55	38	35	......	214.1	371.4	58	38
Vicksburg, Miss	T.	......	11	32	34	44	49	66	71	78	76	74	66	48	35	28	......	208.1	372.1	56	53
Washington, D. C	P.	......	25	27	26	37	41	47	54	53	60	57	46	38	33	43	......	161.3	371.4	43	34
Wilmington, N. C	T.	......	30	25	33	55	61	69	77	80	81	76	69	50	34	34	......	220.2	372.3	59	51
Yankton, S. Dak	T.	......	64	39	58	69	74	79	82	77	76	67	56	40	22	26	......	228.6	370.9	62	37
Basseterre, St. Kitts	T.	......	0	7	9	48	71	83	89	83	90	91	65	39	8	7	......	211.9	374.1	57	38
Bridgetown, Barbados	T.	......	50	13	26	37	45	58	56	49	43	41	32	21	21	23	......	138.3	374.3	37	27
Colon, United States of Columbia	T.	......	0	31	42	60	79	87	91	95	94	79	60	44	40	35	......	249.6	374.7	67	50
Havana, Cuba	T.	......	100	87	84	75	84	84	84	75	71	73	59	41	39	52	......	264.4	373.5	71	69
Kingston, Jamaica, W. I	T.	......	100	73	77	78	71	69	70	76	65	53	42	51	48	36	......	239.3	373.9	64	46
Port of Spain, Trinidad, W. I	T.	......	92	42	55	84	84	89	88	72	65	51	47	32	24	25	......	227.7	374.5	61	33
San Juan, Porto Rico	T.	......	33	14	69	84	91	95	91	84	87	85	78	69	31	2	......	271.3	373.9	73	68
Santiago de Cuba, Cuba	T.	......	100	83	79	76	75	87	83	85	78	78	73	64	61	49	......	285.7	373.6	76	64
Willemstad, Curaçao	T.	......	0	21	66	97	95	97	98	97	97	99	98	86	37	9	......	306.6	374.2	82	56

*All values for 22 days only. †All values for 30 days only.

TABLE IX.—*Accumulated amounts of precipitation for each 5 minutes, for storms in which the rate of fall equaled or exceeded* 0.25 *in any 5 minutes, or* 0.75 *in 1 hour during March,* 1899, *at all stations furnished with self-registering gauges.*

Stations.	Date.	Total duration. From—	Total duration. To—	Total am't of precipitation.	Excessive rate. Began—	Excessive rate. Ended—	Amount before excessive began.	5 min.	10 min.	15 min.	20 min.	25 min.	30 min.	35 min.	40 min.	45 min.	50 min.	60 min.	80 min.	100 min.	120 min.
	1	2	3	4	5	6	7														
Albany, N. Y.	28-29			0.65														*			
Atlanta, Ga.	14-15			1.11														0.68			
Atlantic City, N. J.	18-19			1.47														0.26			
Baltimore, Md.	4-5			1.08														0.36			
Binghamton, N. Y.	4-5			0.49														0.23			
Bismarck, N. Dak.	14-15			0.27														*			
Boise, Idaho	24-25			0.32														0.13			
Boston, Mass.	19			1.29														0.25			
Buffalo, N. Y	17-19			1.22														*			
Cairo, Ill.	17-18			0.98														0.32			
Charleston, S. C.	14			0.59														0.38			
Chicago, Ill.	17-18			0.67														*			
Cincinnati, Ohio	1-2			1.07														0.31			
Cleveland, Ohio	4			0.33														0.18			
Columbia, Mo.	11			0.37								0.35									
Columbus, Ohio	18			0.50														0.22			
Denver, Colo.	25-26			0.62														*			
Des Moines, Iowa.	11-12			0.70														*			
Detroit, Mich.	4-5			1.12														*			
Dodge, Kans	26-27			0.23														*			
Duluth, Minn.	10-11			0.32														*			
Eastport, Me.	19-20			0.92														0.25			
Elkins, W. Va.	28			0.69														0.18			
Erie, Pa.	28-29			0.52														*			
Escanaba, Mich.	10			0.80														*			
Fort Worth, Tex.	13			0.18														0.18			
Fresno, Cal.	15-16			1.05														*			
Galveston, Tex.	28			0.26														0.14			
Grand Junction, Colo.	25			0.22														0.11			
Hannibal, Mo.	14			0.75														*			
Harrisburg, Pa.	28			0.56														0.20			
Hatteras, N. C.	28	9.30 p.m.	11.25 p.m.	0.92	10.15 p.m.	10.40 p.m.	0.05	0.20	0.41	0.52	0.59	0.65	0.70	0.74							
Huron, S. Dak.	14			0.78														*			
Idaho Falls, Idaho	25			0.26														0.10			
Indianapolis, Ind.	17-18			0.70														0.28			
Jacksonville, Fla.	19			0.62														0.52			
Jupiter, Fla.	5	3.40 p.m.	4.40 p.m.	0.62	3.55 p.m.	4.10 p.m.	0.03	0.26	0.51	0.56											
	30	3.40 p.m.	6.40 p.m.	0.75	3.45 p.m.	4.13 p.m.	0.03	0.07	0.22	0.27	0.40	0.53	0.57								
	31	3.50 p.m.	6.30 p.m.	2.05	5.30 p.m.	6.30 p.m.	0.05	0.05	0.10	0.10	0.11	0.20	0.50	0.81	1.26	1.55	1.75	2.00			
Kansas City, Mo.	11-12			1.59														*			
Key West, Fla.	5			0.05											0.05						
Knoxville, Tenn	4	7.35 a.m.	1.55 p.m.	1.65	9.05 a.m.	9.30 a.m.	0.32	0.21	0.36	0.48	0.63	0.67									
	28	10.30 a.m.	4.15 p.m.	1.45	10.45 a.m.	11.35 a.m.	0.03	0.06	0.12	0.18	0.24	0.30	0.40	0.46	0.49	0.57	0.64				
Lincoln, Nebr.	11-12			0.47														*			
Little Rock, Ark.	27	2.20 p.m.	11.45 p.m.	1.04	8.25 p.m.	8.50 p.m.	0.22	0.06	0.24	0.46	0.65	0.69	0.72								
Los Angeles, Cal.	16-17			0.84														*			
Louisville, Ky.	3	5.20 p.m.	6.15 p.m.	0.56	5.22 p.m.	5.42 p.m.	T.	0.07	0.26	0.36	0.50	0.52	0.53								
Memphis, Tenn.	18			0.55														0.43			
Meridian, Miss	15	4.30 a.m.	7.30 a.m.	0.53	5.30 a.m.	5.45 a.m.	0.10	0.09	0.30	0.36	0.37										
Milwaukee, Wis.	17-18			0.70														*			
Montgomery, Ala.	28			0.42									0.42								
Nantucket, Mass.	18-19			3.32														0.55			
Nashville, Tenn.	28			2.32														0.70			
New Orleans, La.	30	5.00 p.m.	9.58 p.m.	1.85	6.40 p.m.	7.20 p.m.	0.26	0.08	0.24	0.40	0.49	0.92	1.13	1.32	1.44						
New York, N. Y.	22-23			1.27														0.40			
Norfolk, Va.	3-4			2.10														0.74			
Northfield, Vt.	5			0.76														*			
Oklahoma, Okla.	11			0.74														*			
Omaha, Nebr.	11-12			0.42														0.08			
Parkersburg, W. Va.	27-28			1.21														0.40			
Philadelphia, Pa.	28			1.07														0.21			
Pittsburg, Pa.	27-28			0.48														*			
Portland, Me.	28-29			0.95														0.36			
Portland, Oreg.	12			0.57														0.17			
Raleigh, N. C.	3			1.01														0.55			
Richmond, Va.	18-19			1.17														0.52			
Rochester, N. Y.	15			0.15														0.14			
St Louis, Mo.	17-18	8.18 p.m.	4.30 a.m.	1.82	1.09 a.m.	2.40 a.m.	0.14	0.08	0.19	0.42	0.54	0.60	0.62	0.65	0.66	0.67	0.74	0.93	1.37	1.47	1.52
St. Paul, Minn.	11-12			1.57														0.28			
Salt Lake City, Utah.	2-3			0.51														*			
San Diego, Cal.	17			0.52														0.15			
San Francisco, Cal	21-23			4.50														0.26			
Savannah, Ga.	28	6.46 p.m.	8.08 p.m.	0.97	7.00 p.m.	7.15 p.m.	T.	0.37	0.51	0.56	0.58	0.59	0.62	0.70	0.75	0.81	0.86	0.96			
Seattle, Wash.	9			0.38														0.10			
Spokane, Wash.	11			0.42														*			
Tampa, Fla	19			0.56					0.51												
	23			0.53					0.45												
Vicksburg, Miss.	13			1.65														0.47			
Washington, D. C.	4-5			1.24														0.38			
Wilmington, N. C.	28			0.47														0.46			
Yankton, S. Dak.	14			0.50														*			
Basseterre, St. Kitts	9			0.53														0.46			
Bridgetown, Barbados	17			0.73														0.23			
Colon, U. S. C.	30			0.52														0.23			
Havana, Cuba.	5			0.47														0.46			
Kingston, Jamaica.	10			0.27													0.27				
Port of Spain, Trin.	25			0.11														0.11			
San Juan, Porto Rico.	23-24			0.78														0.20			
Santiago de Cuba	10			0.42													0.42				
Willemstad, Curaçao.	15			0.26														0.26			

*Record incomplete on account of snow or other causes.

TABLE X.—*Excessive precipitation, by stations, for March*, 1899.

Stations.	Monthly rainfall 10 inches, or more	Rainfall 2.50 inches, or more, in 24 hours.		Rainfall of 1 inch, or more, in one hour.		
		Amt.	Day.	Amt.	Time.	Day.
Alabama.	*Inches.*	*Inches.*		*Ins.*	*h.m.*	
Asheville	11.14	3.88	15			
Bridgeport	14.00	7.51	13-15			
Do		6.82	18			
Daphne		3.03	30			
Decatur	10.80	4.35	19			
Florence		2.81	14			
Gadsden	12.87	6.65	14-15			
Greensboro				2.00	2 00	30
Hamilton		3.00	18			
Jasper		2.65	15			
Madison		2.88	14			
Maple Grove	15.60	9.00	14			
Mobile		5.40	30-31			
Newberg	12.56	7.10	13-14			
Do		2.50	18			
Newton		3.56	31			
Scottsboro	15.56	8.18	13-14			
Valleyhead	10.62	5.10	14-15			
Do		2.60	19			
Warrior	10.56	2.89	14-15			
Wilsonville				1.05	0 40	21
Arkansas						
Elon		2.87	13			
Luna Landing		3.30	13			
Marvell				1.15	0 20	18
California.						
Bear Valley	23.34	2.85	15			
Do		7.42	23-24			
Berkeley	13.19	3.20	22			
Bowmans Dam	26.31	11.35	22-24			
Crescent City	11.62					
Drytown	11.14					
Edmanton	17.04	2.90	15			
Do		6.14	23-24			
Fordyce Dam	21.41	2.60	15			
Do		9.20	22-24			
Fort Ross	16.11	8.30	22-23			
Georgetown	21.39	2.55	15			
Do		9.14	23-25			
Grass Valley	19.60	3.16	15			
Do		9.11	22-24			
Iowa Hill	18.06	5.21	23-24			
Jackson	14.60	5.33	23-21			
Kennedy Gold Mine	12.54					
Laporte	25.26	9.11	23-24			
Los Gatos	11.10	4.00	15			
Malakoff Mine	18.24	3.03	15			
Do		2.99	23			
Mills College	13.62	2.70	15			
Do		7.62	22-24			
Milton	10.88	2.52	15			
Mokelumne Hill	13.27					
Mount Tamalpais	10.38	2.51	22-23			
Nevada City	15.88	3.08	15			
Do		2.78	23			
North San Juan	16.02	6.10	23-24			
Oakland	12.16	6.23	22-23			
Oleta	12.43					
Peachland	10.25	2.83	22			
Pilot Creek	26.20	2.61	15			
Do		11.91	22-24			
Placerville	14.98					
Redding		2.95	24			
San Leandro	10.85					
Santa Cruz		2.80	22			
Shasta	10.15					
Summerdale	18.66	2.95	16			
Do		9.56	23-25			
Upper Mattole	11.25					
Vacaville	10.26	3.84	22			
Westpoint	15.39	8.07	22-24			
Wire Bridge	13.18					
Florida.						
Defuniak Springs		3.00	31			
Earnestville				1.25	0 30	23
Haywood		2.50	30			
Jupiter				2.00	1 00	31
Pensacola		4.90	30-31	4.50	3 16	31
St. Francis Barracks				1.25	1 15	18
Georgia.						
Adairsville		2.70	15			
Canton		3.00	14-15			
Clayton	10.29	2.50	15			
Dahlonega	10.07	2.51	15			
Diamond		2.70	15			
Gillsville		3.02	15			
Greenbush	10.22	2.59	15			
Resaca	10.01	3.10	18			
Rome		3.58	14-15			
Kansas.						
Centropolis		3.00	11			
Kentucky.						
Alpha	12.13	3.25	27-28	1.55	1 00	3
Ashland		2.50	4			
Burnside	11.94					
Edmonton	10.73	4.43	3-4			
Eubanks	11.53	3.80	3-4			
Greensburg	10.32					
Jackstown		3.00	3-4			
Marrowbone	10.81	3.02	4			
Kentucky—Continued.	*Inches.*	*Inches.*		*Ins.*	*h.m.*	
Middlesboro	10.23	3.02	28			
Mount Hermon	12.80	4.75	4			
Do		2.77	28			
Mount Sterling	12.58	2.64	4			
Vanceburg		2.50	4			
Louisiana.						
Bastrop		4.31	13	1.22	0 30	14
Farmerville		4.14	13			
Lake Providence		3.57	14			
Liberty Hill		4 40	13			
Mansfield		5.27	13			
Minden				1.70	0 25	15
New Orleans				1.44	0 42	30
Oakridge		3.06	14			
Oxford		3.65	13			
Ruston		3.92	13			
Sugar Experiment Station		2.60	29			
Massachusetts.						
Hyannis		4.36	18-19			
Nantucket		3.22	18-19			
New Bedford		2.75	18-19			
Woods Hole		3.74	18-19	1.00	0 35	19
Michigan.						
Cheboygan		2.50	11			
Minnesota.						
New Ulm		4.31	12			
Mississippi.						
Aberdeen		2.60	13-14			
Agricultural College		2.71	14			
Bay St. Louis		4.39	30-31			
Biloxi	11.67	10.50	30			
Canton		2.50	13			
Columbus	10.71	4.81	14-15			
Greenville		3.30	13-14			
Greenwood		5.59	13			
Louisville		3.40	13			
Do		2.51	16			
Tupelo		3.05	13-14			
Water Valley		2.74	14			
Windham		2.86	11			
Missouri.						
St. Louis				1.08	1 00	18
Nebraska.						
Bassett		3.00	14			
Nevada.						
Halleck		3.00	29			
Lewers Ranch		2.80	23			
New York.						
Cutchogue		3.90	18-19			
Kings Station		2.55	19			
North Carolina.						
Abshers	10.06					
Asheville		2.73	14-15			
Bryson City	12.77	3.46	14-15			
Do		3.70	18-19			
Flatrock	11.01	2.85	19			
Horse Cove	13.15	3.14	15			
Do		4.00	18			
Lenoir	11.84	4.29	18-19			
Linville	11.89	2.90	19			
Mana	10.24	2.98	19			
Marion	12.68	3.32	19			
Marshall	10.79					
Mocksville		2.65	19			
Morganton	10.82					
Mountairy		3.63	18			
Murphy	12.72	4.31	18- 9			
Patterson	12.76	2.60	18			
Salem		2.55	18-19			
Saxon		3.44	18			
Settle		3.00	18			
Waynesville	13.01	3.79	18			
Ohio.						
Vanceburg		2.50	28			
Oregon.						
Glenora	12.57	2.76	1			
Government Camp	13.28					
Langlois	11.55					
Pennsylvania.						
Hawthorn	10.30	2.50	28			
Rhode Island.						
Block Island		4.29	18-19			
Kingston		3.79	18-19			
Narragansett		3.40	18-19			
South Carolina.						
Central		2.62	13			
Tennessee.						
Andersonville	10.45					
Ashwood		2.66	28			
Benton	17.06	6.17	14-15			
Do		3.25	18			
Byrdstown	10.39					
Chattanooga	14.05	6.91	13-15			
Do		4.04	18-19			
Decatur	12.17	5.69	14-15			
Elizabethton	10.72					
Elk Valley	10.21	3.10	28			
Florence		3.10	28			
Franklin		2.50	28			
Greeneville	10.51	2.90	18-19			

TABLE X.—*Excessive precipitation*—Continued.

Stations.	Monthly rainfall 10 inches, or more.	Rainfall 2.50 inches, or more, in 24 hours.		Rainfall of 1 inch, or more, in one hour.		
		Amt.	Day.	Amt.	Time.	Day.
Tennessee—Continued.	*Inches.*	*Inches.*		*Ins.*	*h.m.*	
Jonesboro	11.01					
Kingston		2.60	13-14			
Knoxville	11.28	2.93	18-19			
Lafayette	11.75	2.50	28			
McMinnville		2.60	18			
Madison		2.86	28			
Maryville	13.78	3.39	18-19			
Newport	11.88	3.43	18-19			
Oakhill	13.29					
Silver Lake	10.77					
Springdale	10.47					
Springfield		3.15	4			
Sylvia		2.60	4			
Tazewell	10.34					
Tellico Plains	11.09					
Tracy City	10.30	3.32	14			
Waynesboro		2.50	28			
Yukon		3.26	14			
Virginia.						
Bigstone Gap	11.50					
Buckingham		2.93	18			
Burkes Garden	10.09					
Colemans Falls		2.68	18-19			
Farmville		2.50	4			
Lynchburg		3.10	18-19			
Rockymount		2.70	19			
Washington.						
Cle Elum		2.50	1			
West Virginia.						
Green Sulphur Springs		2.75	3			
Hamlin		2.70	4			
Do		3.10	27			
Huntington		2.85	24-25			

TABLE XI.—*Data furnished by the Canadian Meteorological Service, March,* 1899.

Stations.	Pressure.			Temperature.				Precipitation.		
	Mean not reduced.	Mean reduced.	Departure from normal.	Mean.	Departure from normal.	Mean maximum.	Mean minimum.	Total.	Departure from normal.	Depth of snow.
	Ins.	*Ins.*	*Ins.*	°	°	°	°	*Ins.*	*Ins.*	*Ins.*
St. Johns, N. F	29.73	29.90	+.06	26.1	− 1.6	32.7	19.5	2.50		2.0
Sydney, C. B. I	29.92	29.96	+.09	25.8	− 0.4	33.6	18.0	3.73	−1.52	11.5
Halifax, N. S	29.84	29.98	+.09	30.4	+ 1.4	37.7	23.1	7.17	+1.31	17.3
Grand Manan, N. B	29.89	29.94	+.04	28.5	− 1.3	35.3	21.7	5.14	+0.99	13.3
Yarmouth, N. S	29.87	29.95	+.07	30.8	0.0	36.9	24.6	7.20	+2.34	21.3
Charlottet'n, P. E. I	29.89	29.93	+.05	26.3	+ 0.9	34.0	18.6	4.04	+0.63	25.0
Chatham, N. B	29.92	29.94	+.04	22.7	− 0.3	32.5	12.9	4.65	+0.41	36.9
Father Point, Que	29.92	29.95	+.04	20.0	− 0.3	28.9	11.1	5.09	+2.63	49.5
Quebec, Que	29.60	29.95	.00	20.5	− 0.7	27.8	13.3	4.78	+0.87	44.6
Montreal, Que	29.72	29.94	−.02	22.5	− 1.3	29.2	15.9	8.53	+4.84	43.7
Rockliffe, Ont	29.34	29.88	−.10	15.8	− 3.5	27.8	3.9	3.20	+0.91	28.0
Ottawa, Ont	29.60	29.94		21.8	+ 0.3	30.1	13.6	5.68		45.9
Kingston, Ont	29.61	29.94	−.06	25.9	+ 0.3	33.4	18.4	3.43	+0.37	18.4
Toronto, Ont	29.55	29.95	−.08	28.6	+ 1.3	35.3	21.8	4.26	+1.66	14.8
White River, Ont	28.63	30.09	−.01	4.8	− 7.4	22.6	−13.1	1.58	+0.43	15.8
Port Stanley, Ont	29.27	29.94	−.08	28.9	+ 1.7	35.8	22.1	4.90	+2.04	18.4
Saugeen, Ont	29.20	29.95	−.07	24.7	0.0	33.1	16.3	3.52	+0.97	29.6
Parry Sound, Ont	29.21	29.95	−.07	20.6	− 0.5	32.3	8.9	4.54	+1.92	26.2
Port Arthur, Ont	29.30	30.05	−.04	9.9	− 6.9	22.0	− 2.2	0.34	−0.83	3.4
Winnipeg, Man	29.25	30.15	+.02	3.2	− 9.1	16.1	− 9.8	0.36	−0.66	3.6
Minnedosa, Man	28.21	30.19	+.09	0.2	−12.3	11.6	−11.3	0.47	−0.19	4.7
Qu'Appelle, Assin	27.70	30.15	+.07	1.3	−13.6	10.5	− 7.9	1.57	+0.93	15.7
Medicine Hat, Assin	27.69	30.16	+.12	8.3	−19.2	20.8	− 4.2	1.17	+0.56	11.7
Swift Current, Assin	27.41	30.20	+.11	4.9	−17.1	14.6	− 4.8	1.31	+0.49	13.1
Calgary, Alberta	26.32	30.09	+.04	8.8	−17.4	20.2	− 2.7	1.13	+0.37	11.3
Banff, Alberta	25.21	30.07		15.8		28.4	3.2	1.83		18.3
Edmonton, Alberta	27.66	30.13	+.13	8.5	−15.7	19.8	− 2.8	0.33	−0.32	3.3
Prince Albert, Sask	28.46	30.11		1.5	−10.5	13.4	−10.5	1.84		18.4
Battleford, Sask	28.31	30.21		1.9	−11.2	11.9	− 8.1	0.83		8.3
Kamloops, B. C										
Esquimalt, B. C	29.92	29.95		42.1	0.0	48.5	35.7	2.45		2.4
Hamilton, Bermuda	29.95	30.11	+.06	64.2	+ 2.0	69.9	58.6	2.66		

Chart I. Tracks of Centers of High Areas. March, 1899.

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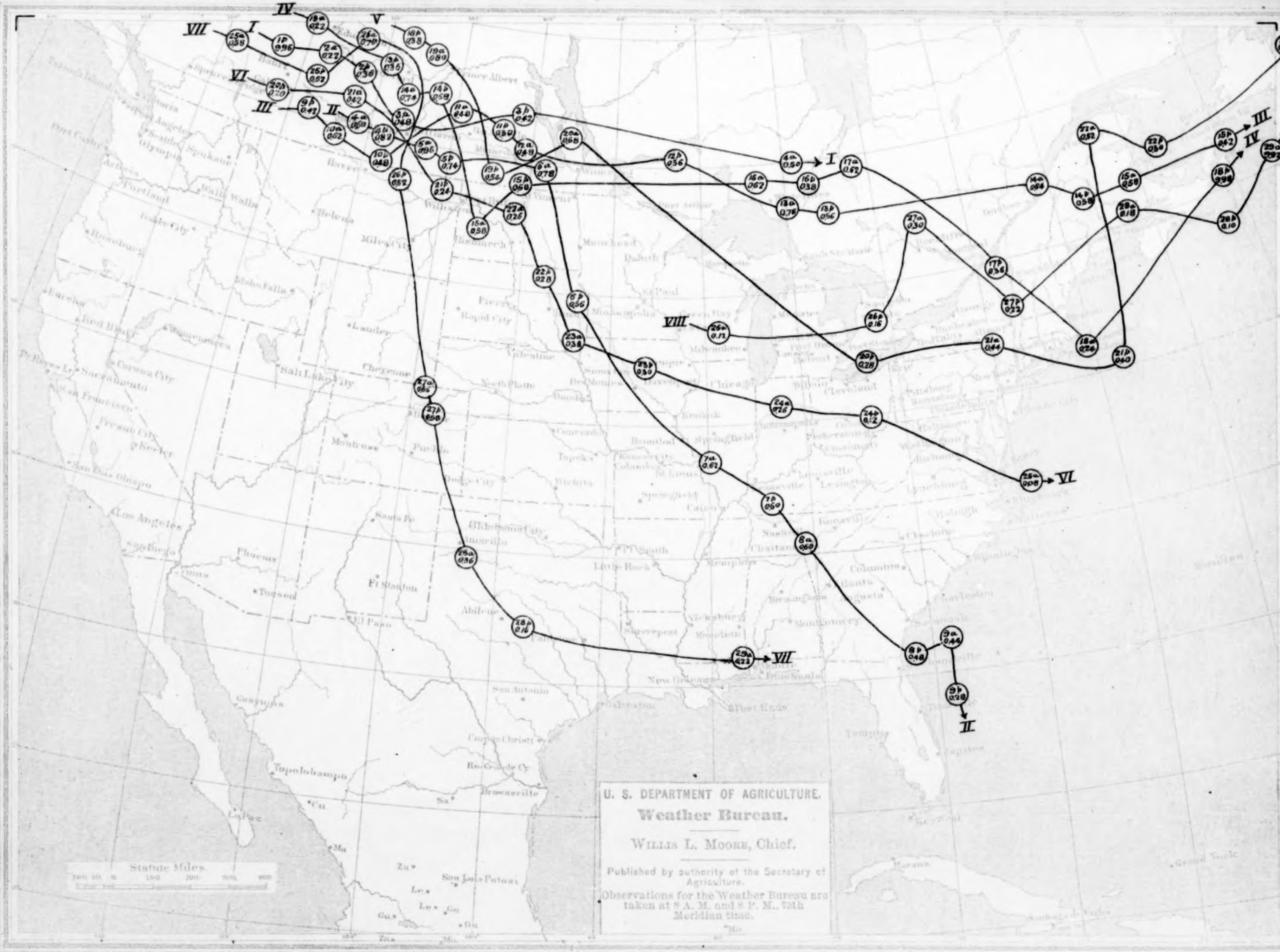

Chart II. Tracks of Centers of Low Areas. March, 1899.

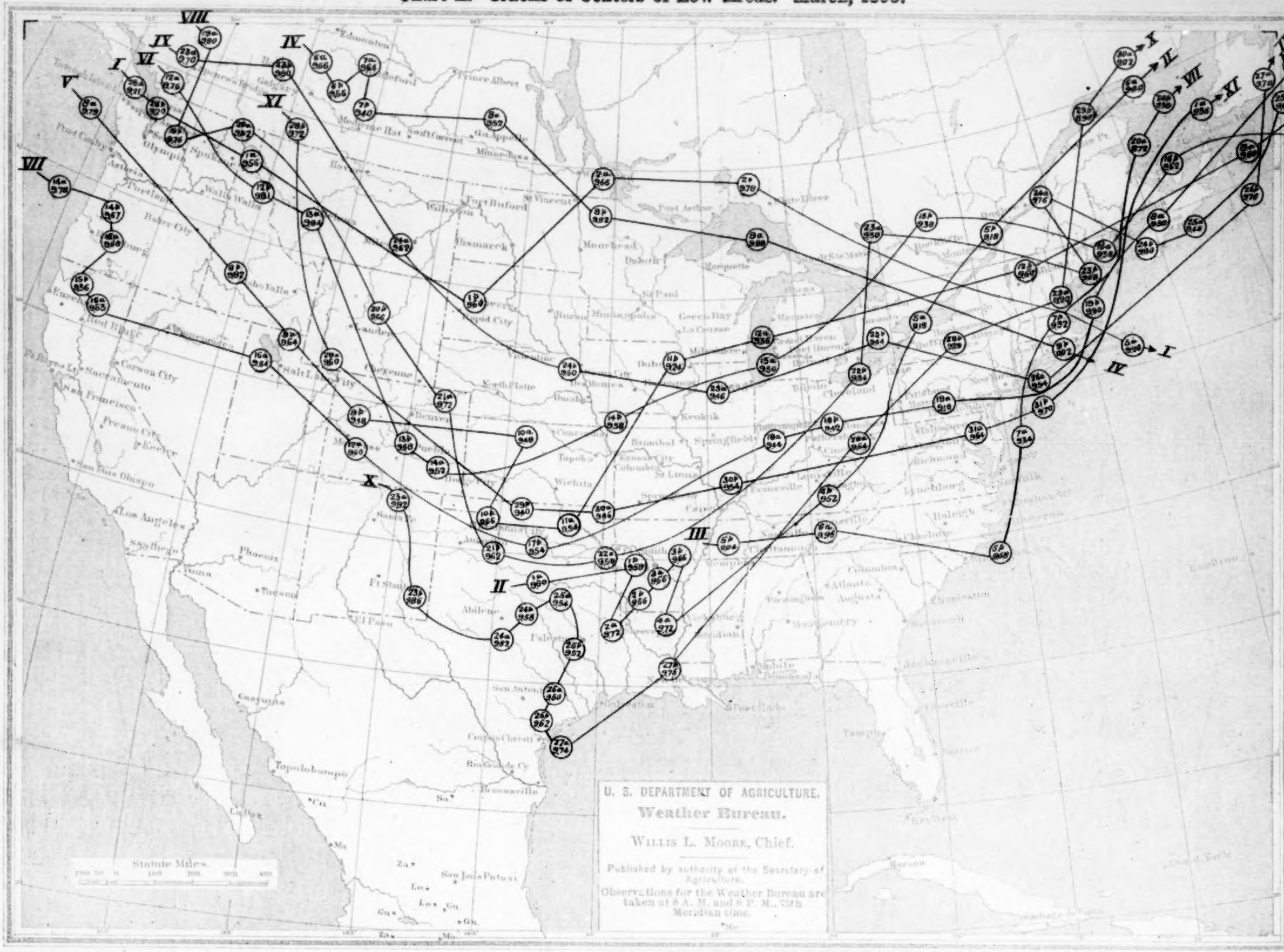

Chart III. Total Precipitation. March, 1899.

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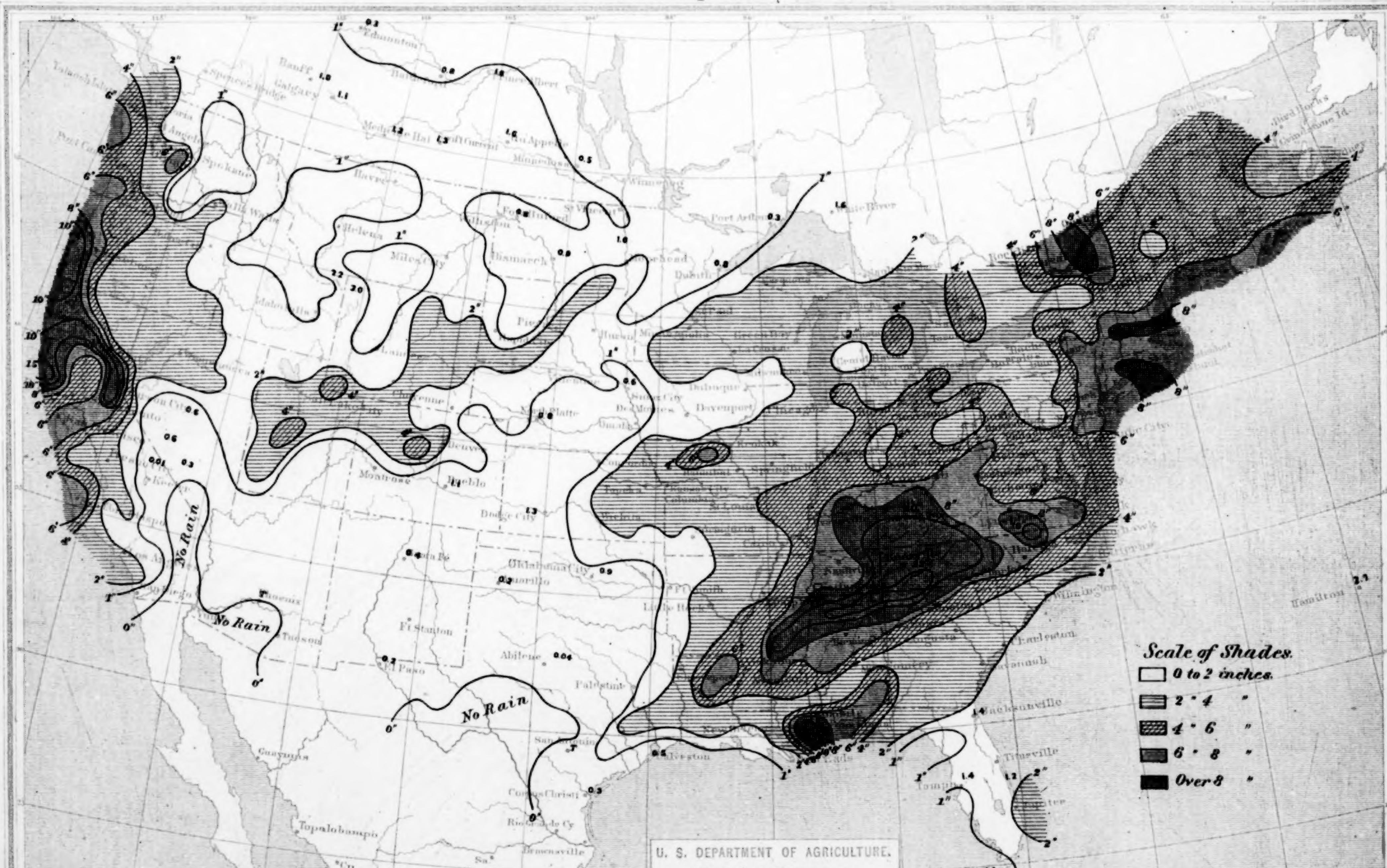

Chart IV. Sea-Level Pressure and Temperature; Resultant Surface Winds. March, 1899.

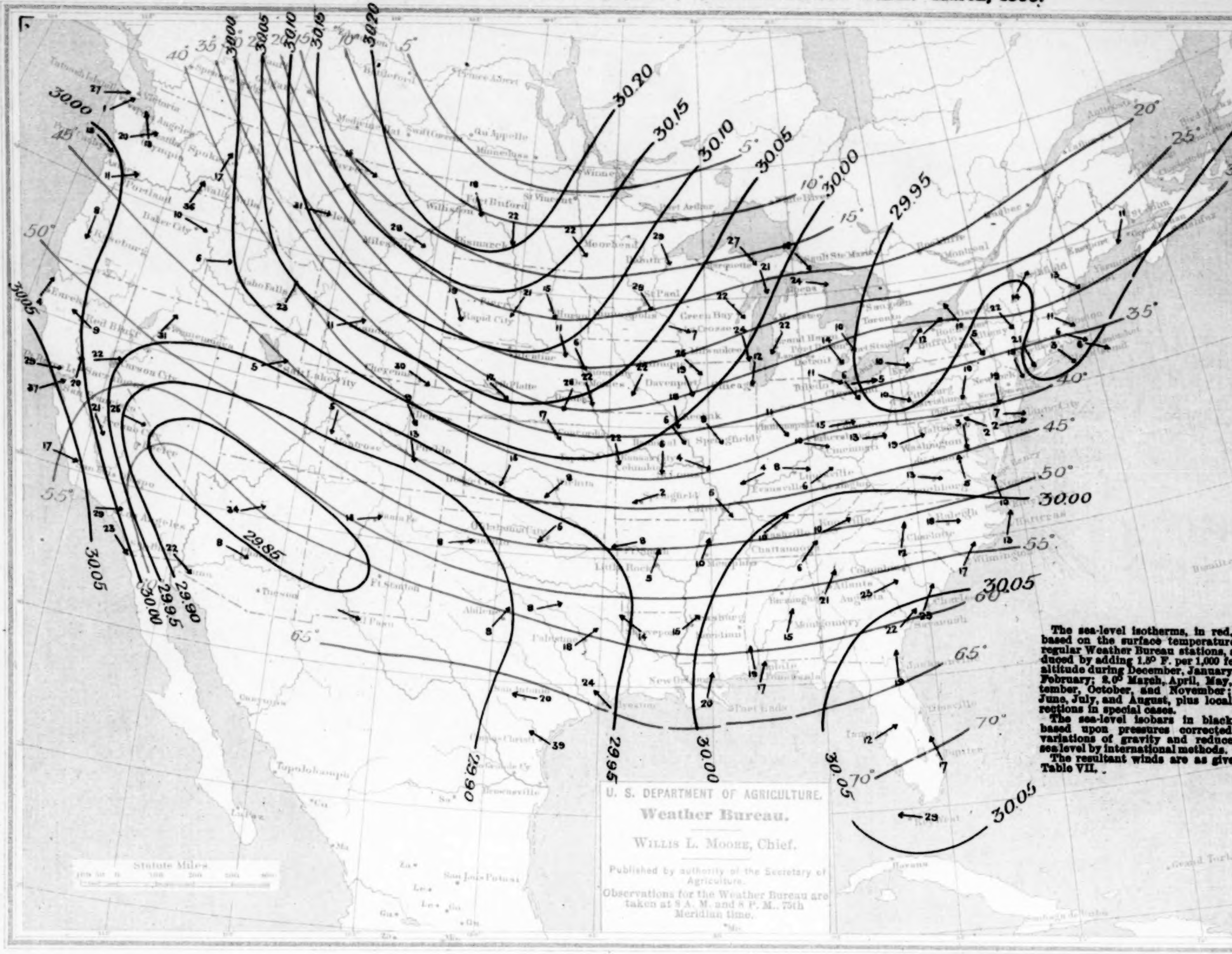

Chart V. Hydrographs for Seven Principal Rivers of the United States. March, 1899.

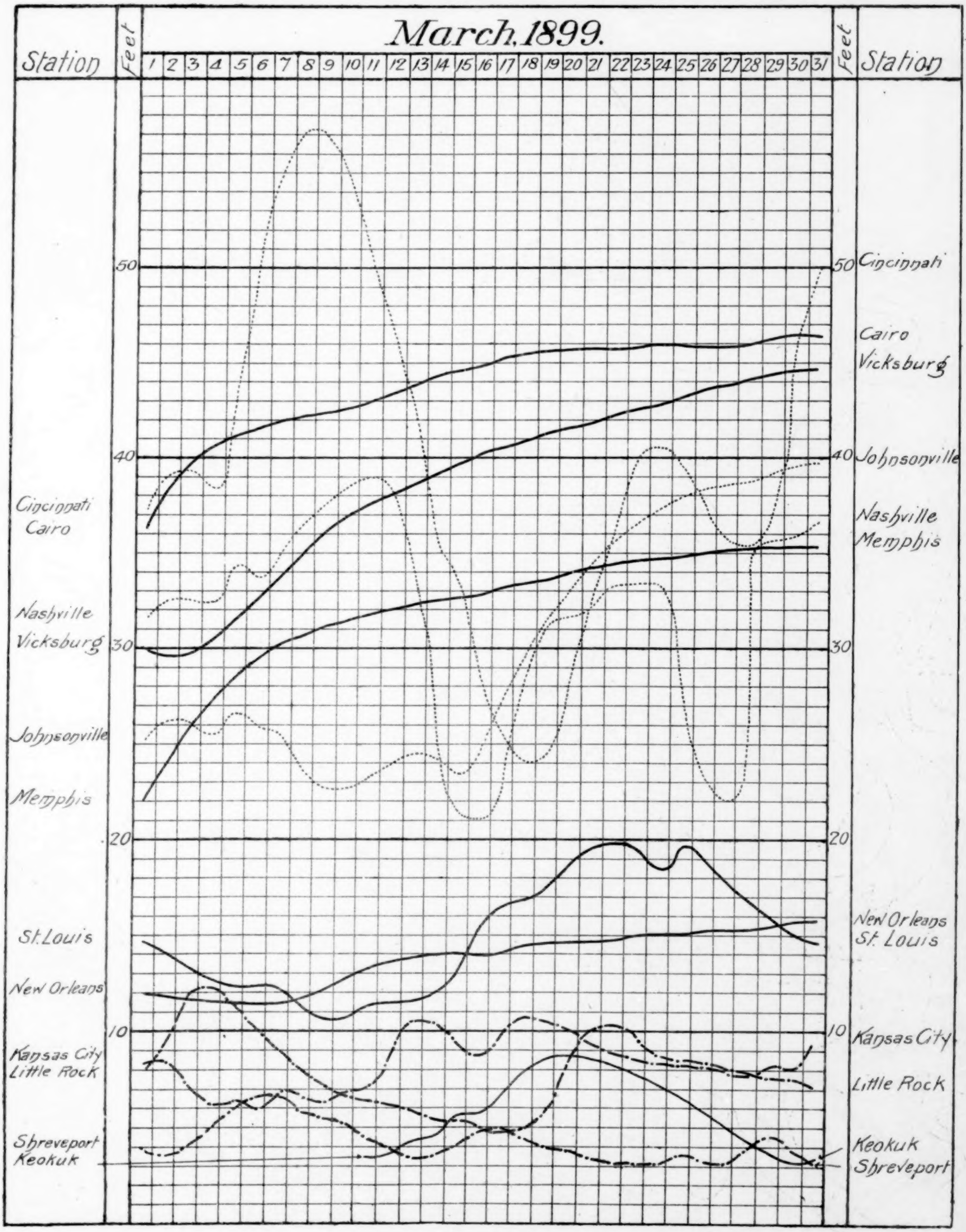

Chart VI. Surface Temperatures; Maximum, Minimum, and Mean: March, 1899.

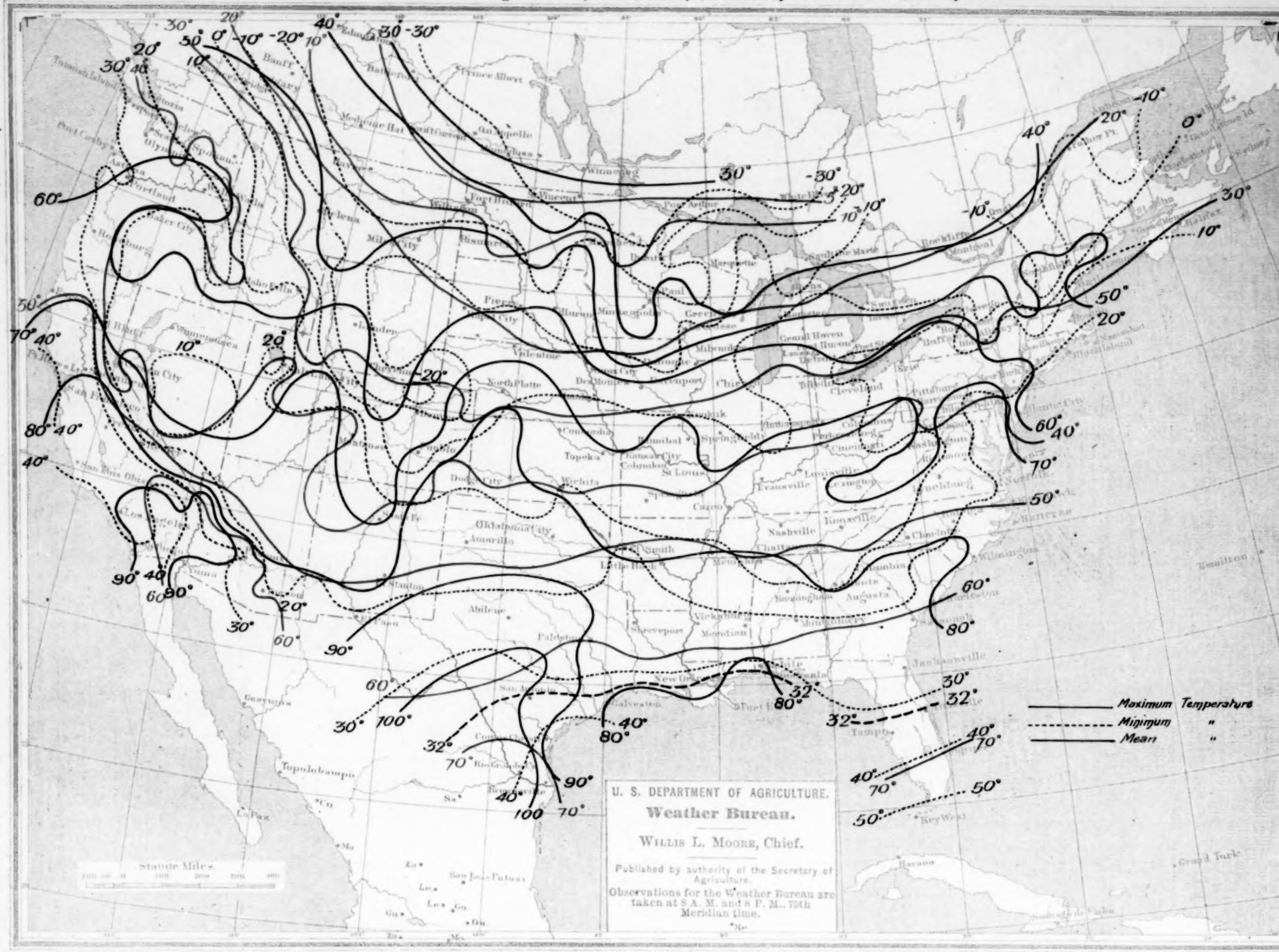

Chart VII. Percentage of Sunshine. March, 1899.

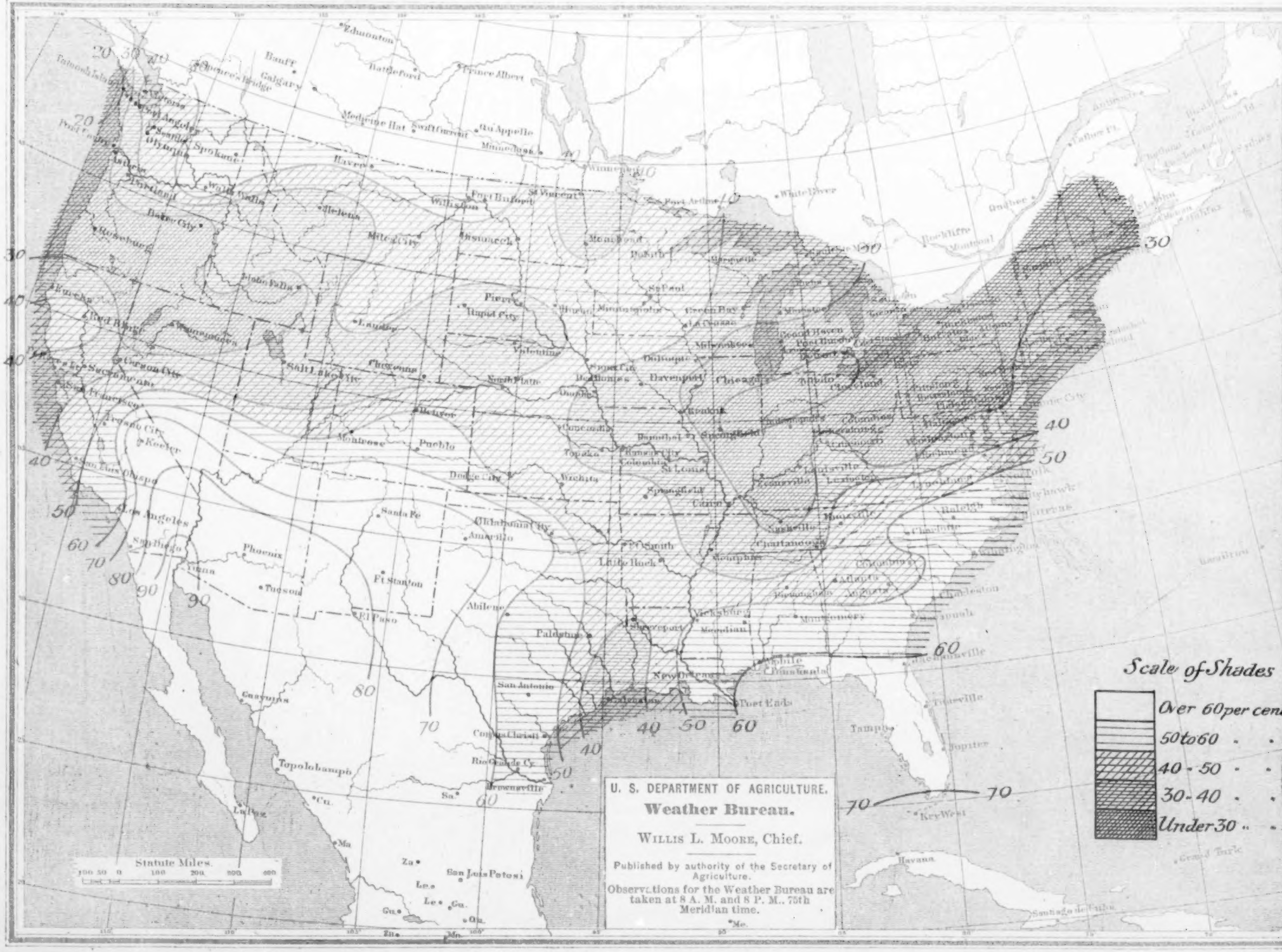

Chart VIII. Total Snowfall. March, 1899.

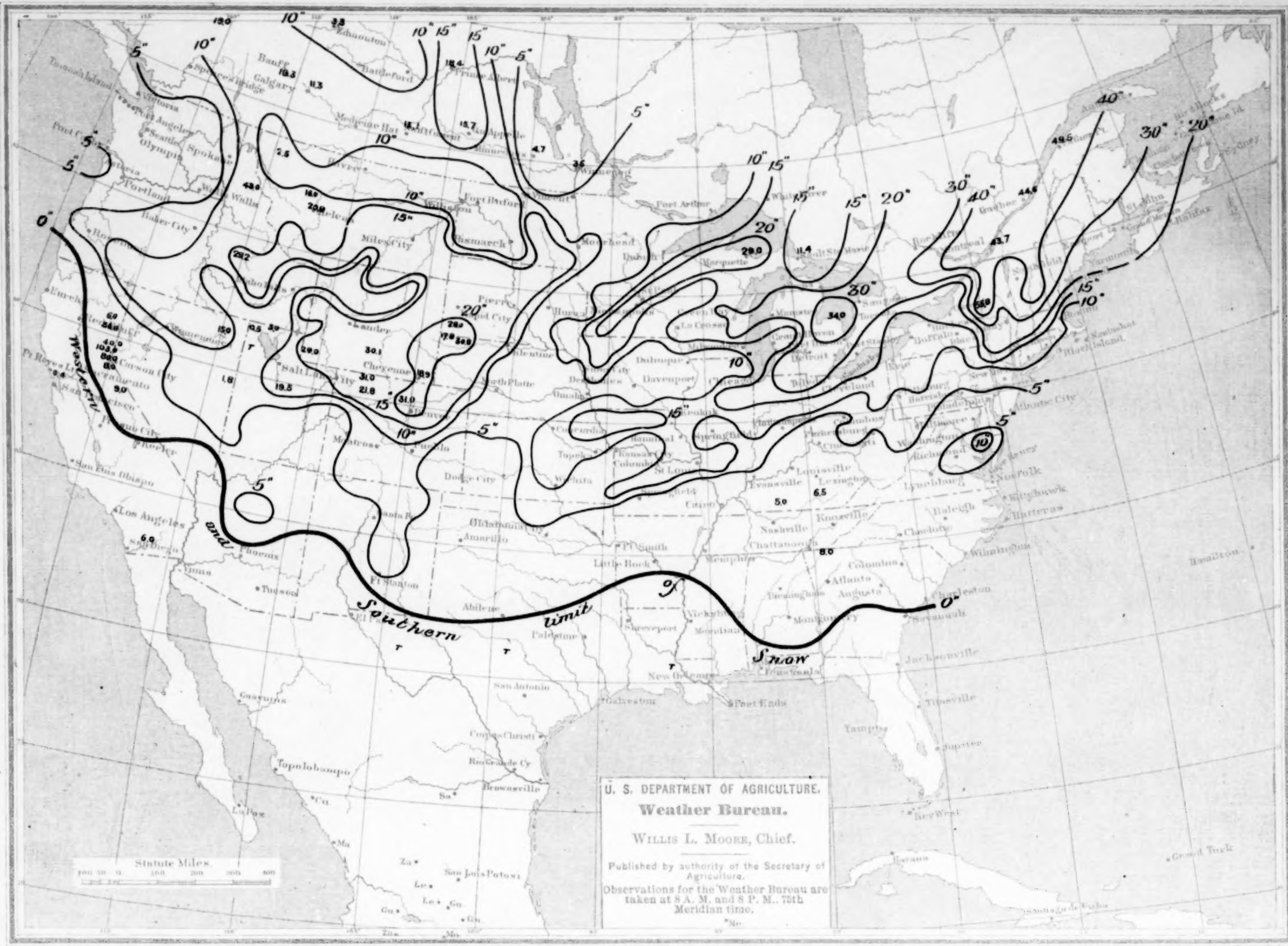

Chart IX. Snow on ground at the end of the month. March, 1899.

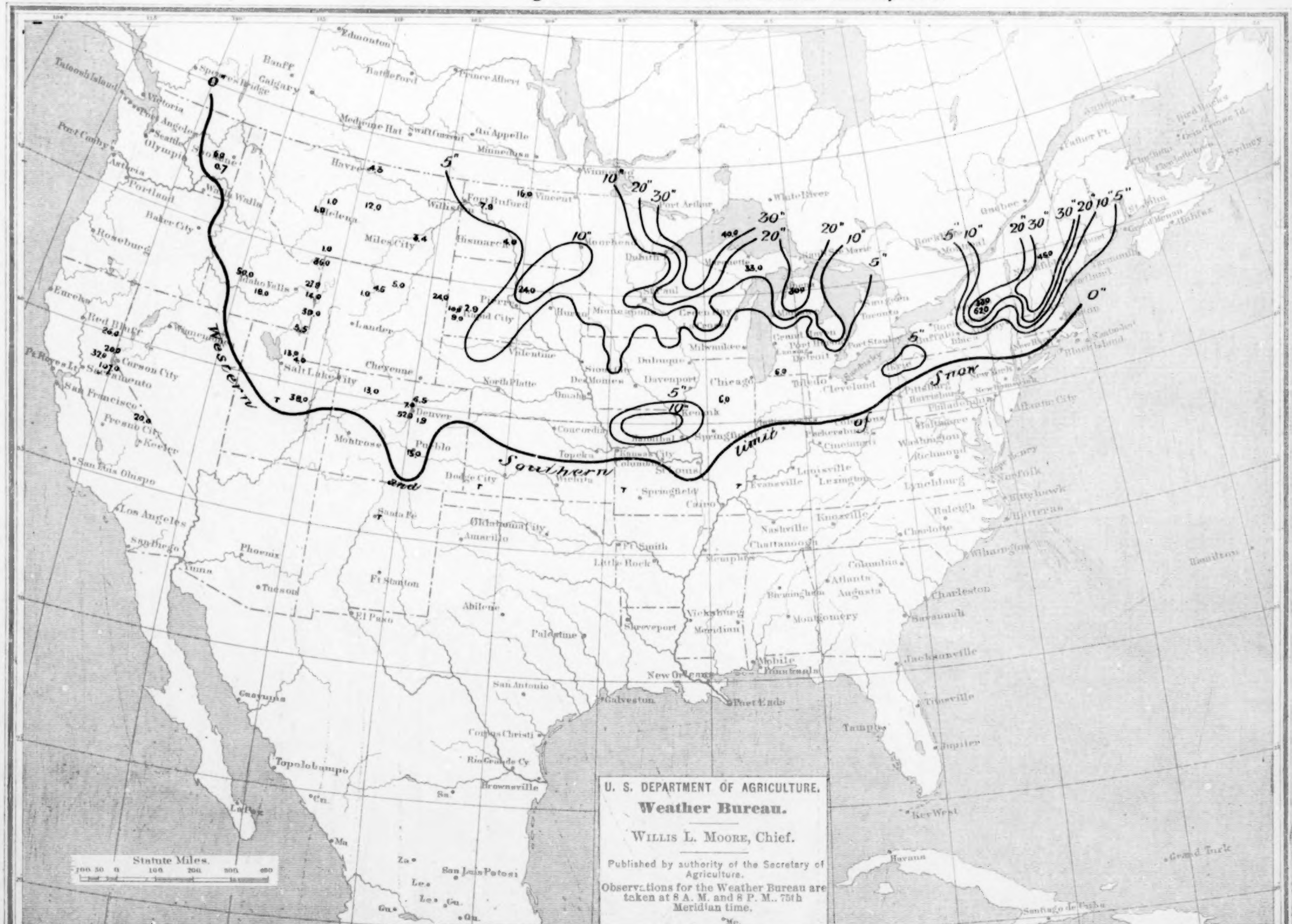

Chart X. British Columbian Daily Weather Map, March 7, 1899.

(8 p. m., 75th Meridian Time.)

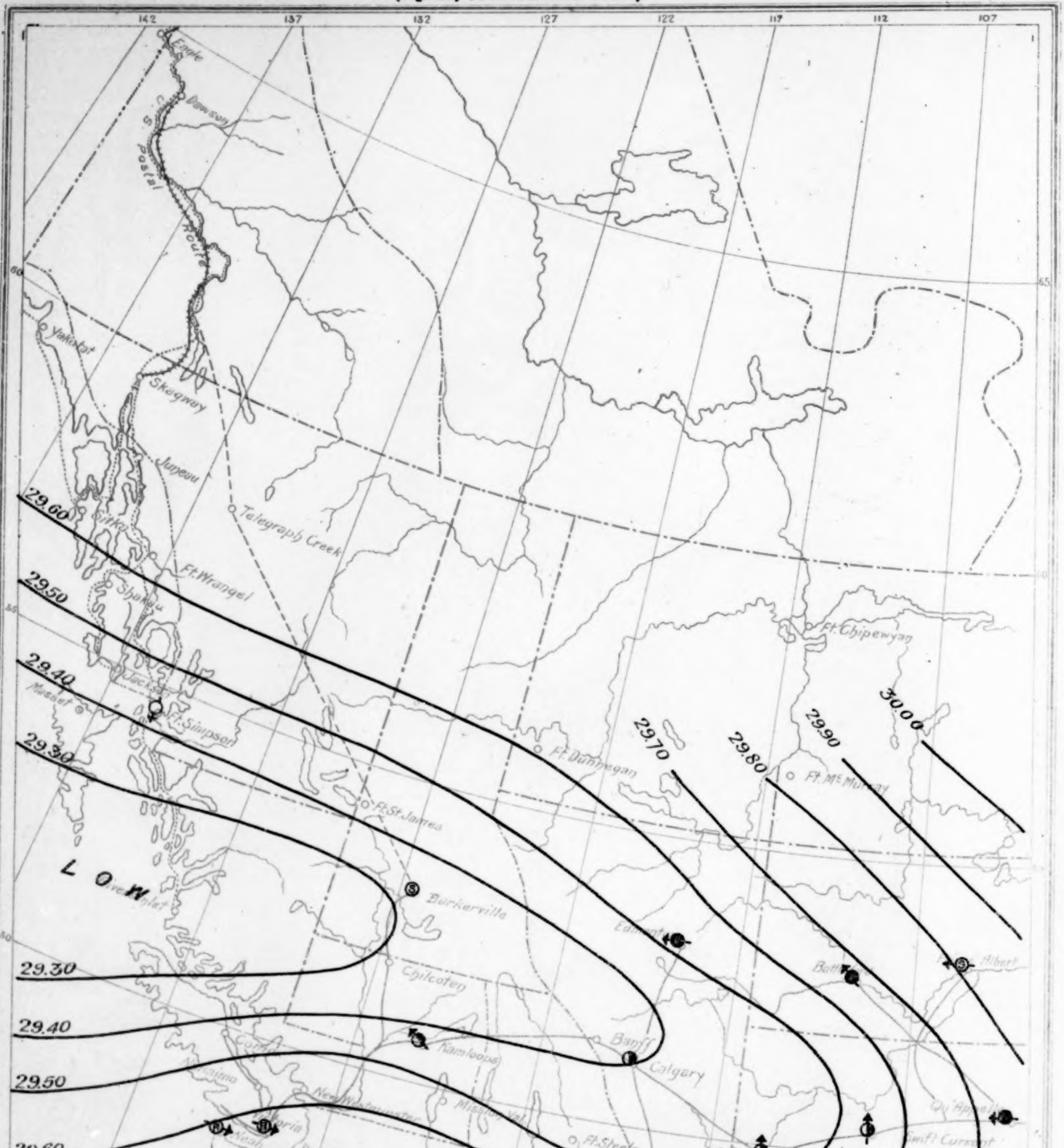

Chart XI. Mexican Daily Weather Map, March 2, 1899.

Chart XI. Mexican Daily Weather Map, March 2, 1899.

(8 a. m., 75th Meridian Time.)

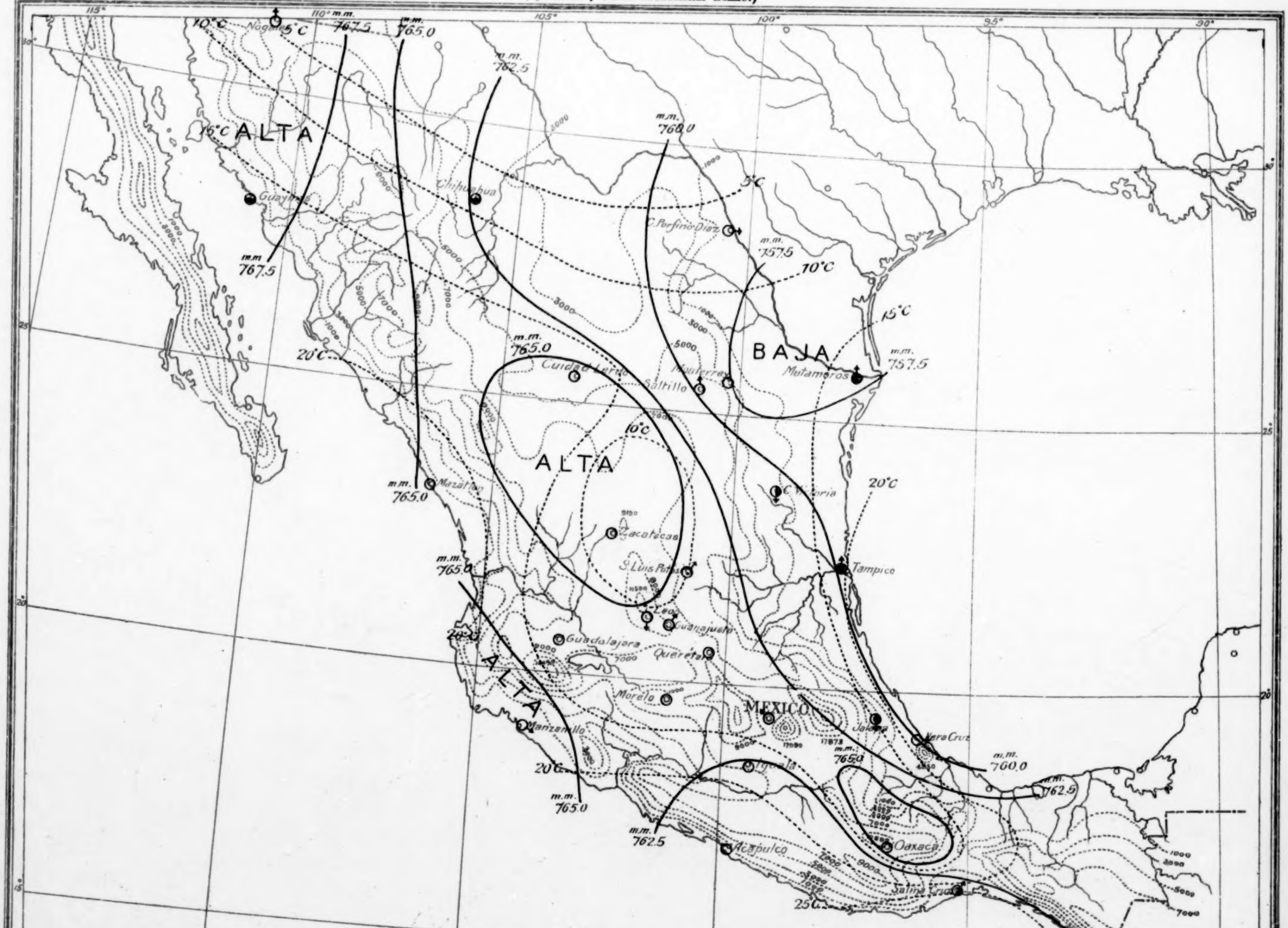

Chart XII. West Indian Monthly Isobars, Isotherms, and Resultant Winds. January, 1899.

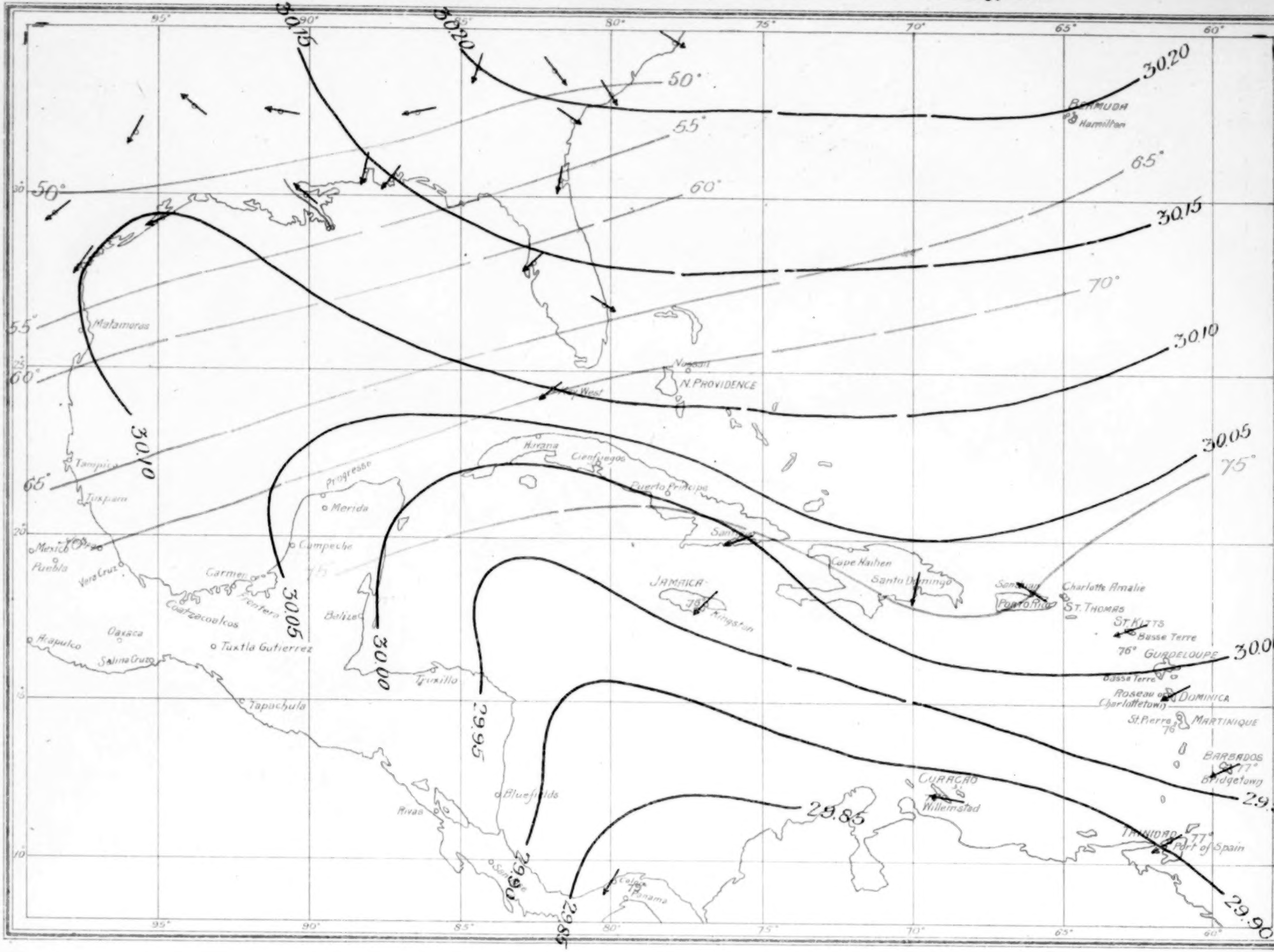

Chart XIII. West Indian Monthly Isobars, Isotherms, and Resultant Winds. February, 1899.